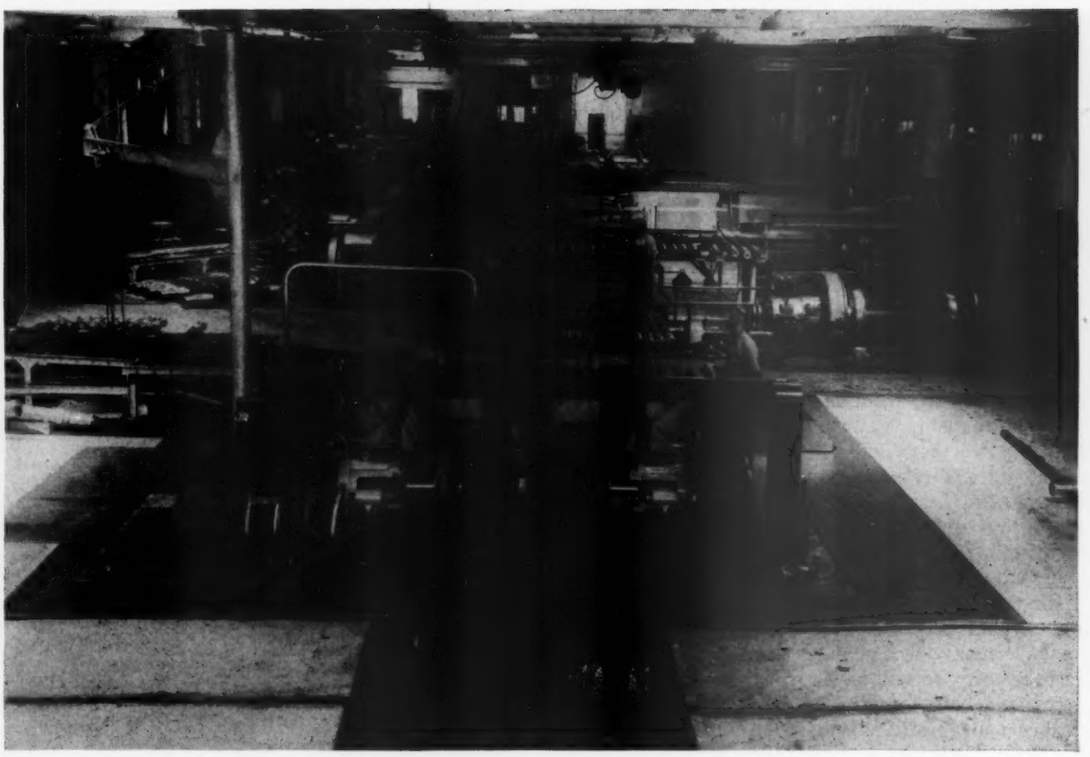


300-ton mounting press in the foreground at St. Paul wheel shop.

New Great Northern Wheel Shop

Modern shop at St. Paul, Minn., is designed to turn out 200 pairs of freight car wheels a day on a production basis with high accuracy and minimum manual handling

IN ORDER to provide about 46,000 pairs of mounted freight-car wheels annually, not to mention passenger-car and diesel locomotive wheels, the Great Northern has constructed a modern wheel shop at St. Paul, Minn. The shop is not yet in full production; in fact two machines are still to be installed, but 180 pairs of wheels are already being turned out daily, including 100 pairs of new freight-car wheels.

Association of American Railroads standards of accuracy and finish are fully maintained and the work is performed by a force of 17 mechanics and 7 helpers turning out mostly freight-car wheels during the day shift and a force of 9 mechanics and 2 helpers averaging about 17 pairs of passenger-car wheels and 8 pairs of diesel wheels on the night shift. The above force includes maintenance men, tool room men, etc. An idea of production

Watson-Stillman 600-ton dismounting press set on its side in the shop floor.

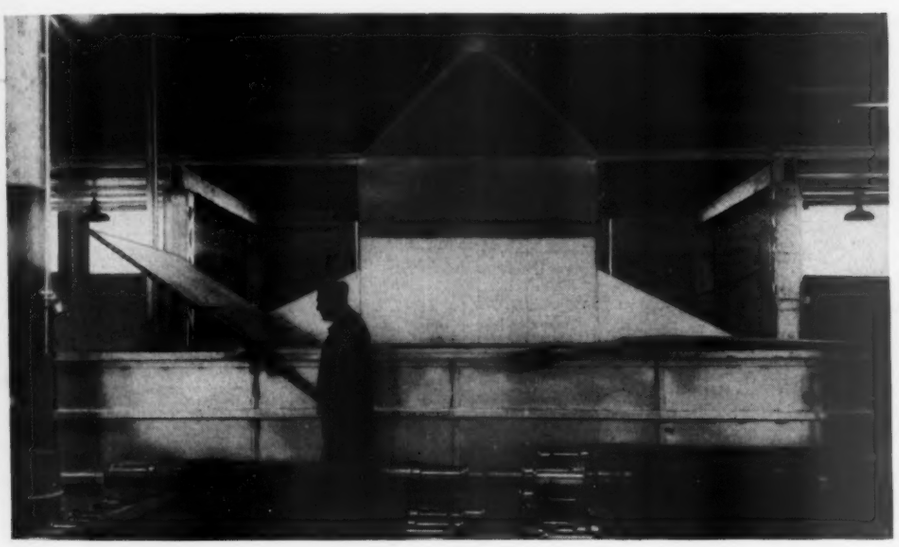
possibilities is afforded by the following stop-watch record of floor to floor times for a pair of wheels or single axle: wheels dismounted, 40 sec.; axle centered, 1 min. 20 sec.; wheel seats and journals machined, 13 min.; axle magnaglo-tested, 2 min.; wheels pressed on, 1 min. 5 sec. It is conservatively estimated that, in addition to getting more and better service from car wheels of all types due to quality workmanship in this modern-equipped wheel shop, the Great Northern will effect labor and other savings equivalent to a return of over 15 per cent on the investment.

The new wheel shop was located at Jackson Street, St. Paul, because of convenience in supplying the large number of mounted car wheels required annually at Superior for the Iron Range and at St. Cloud, Minn., for the freight-car building program, also at St. Paul where many passenger-car wheel changes are made. The entire east end of the railroad will be served, however, and some wheels, particularly for a limited number of passenger cars and diesel locomotives, will be shipped as far west as Havre, Mont. Forty-three special flat cars, designed to hold 44 pairs of wheels per car (with double-deck loading), are available for this large wheel movement over

Wheel-lowering device and horizontal pullet-type wheel conveyor.

Where axles roll through to storage and wheels to scrap-wheel elevators.

How monorail passes the wheel press and circles the scrap-wheel elevators.



Diesel wheel-degreasing tank, with one of the counterweighted covers partly raised.

the system. Similarly, six modern steel flat cars are used to ship either passenger-car or diesel wheels, 11 pairs per car. Two of the six cars are roller-bearing equipped. These wheel cars require no blocking of wheels except to tie down those at each end of the car.

Building Changes Required

The building at Jackson Street which best met requirements for the type of wheel shop planned was the old passenger-car machine shop, 140 ft. wide by 300 ft. long, which provided ample space, but required certain structural changes and additions such as reinforcing roof trusses; taking out post supports; installing machine foundations and a concrete floor, also ramps, conveyors and overhead cranes of all types; making necessary track revisions; constructing outside traveling cranes for loading and unloading wheel cars, also concrete platforms for storing wheels.

Entirely aside from layout and facilities to speed up the movement of wheels and axles and minimize manual labor, the equipment of new shop will include: (1) a Watson-Stillman 600-ton press laid on its side in the shop floor so both wheels can be pressed off an axle and roll through to automatic elevators; (2) another Watson-Stillman 300-ton double-mounting roll-through press with easy floor level adjustment for different-size wheels; (3) Whiton powerful and accurate roll-through axle-centering machine; (4) Magnaglo test machine equipped for quick but thorough double-end axle inspection and also inspecting diesel wheels; (5) automatic fiber-brush cleaning of incoming axle journals and wire brushing of axle centers; (6) Sellers high-production profile-cutting wheel lathe and end-drive axle lathes; (7) two modern Betts car-wheel borers with special provision for supplying and taking away car wheels; (8) A.C.F. 45-in. wheel-tread grinding machine with drive set in the shop floor and used to true the wheel treads on passenger-car and diesel wheels and about 25 per cent of Great Northern freight-car wheels just before they leave the shop; (9) electric-eyes to control mounted-wheel door openings in winter and warn of a plugged scrap-wheel chute; (10) numerous electric stops and interlocks working in conjunction with

One of the three Sellers high-production end-drive axle lathes.

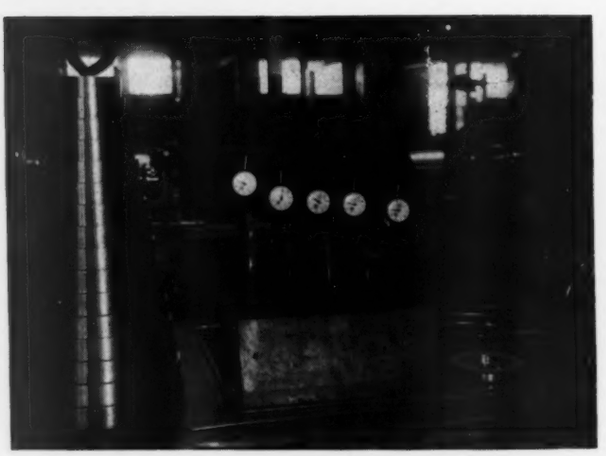
pneumatic cylinders to make the entire shop conveyor and crane operation automatic insofar as practicable.

The shop lighting and painting are both modern and functional. Ceiling mercury-vapor lamps, alternated with high-wattage, incandescent lamps, brilliantly illuminate an aluminum interior with gray floor and with red floor sections designating important machinery. The aisles and machine positions are outlined with special floor-lining tape of bright yellow.

General Method of Operation

Incoming bad-order wheels are switched to the shop where a storehouse craneman picks them up with a Heppenstall automatic lifting tongs. They enter the shop at 1* and roll on an overhead incline the full length of the shop, or about 290 ft. Thus, approximately 100 pairs of wheels needing repair are stored and ready for automatic dismounting without further manpower requirements. An

* See drawing page 62.



Gage blocks, micrometer calipers and special gages required for high standards of accuracy.

Double-end, cycling Magnaglo axle-test machine, set for testing diesel wheels.

How incoming new wheels, delivered by hand truck, are titled into covered and heated conveyors.

ingenious elevator *2* and conveyor *3*, run by the weight of the b. o. wheels and controlled by a small horsepower worm-drive, bring each pair of wheels in its turn to the 600-ton dismounting press *4* which is oil-gear-driven and has an interlocked hydraulic elevator.

Wheels are removed from axles on pneumatically controlled carts and roll down inclines into two scrap wheel chutes *5*. They are automatically raised in scrap wheel elevators and dispatched along overhead rolling inclines *6* through the shop wall to one of four pre-selected bins outside the shop. Good wheels for reclaiming are placed on a horizontal power-driven roller-wheel conveyor *10* and move automatically back to the boring mills.

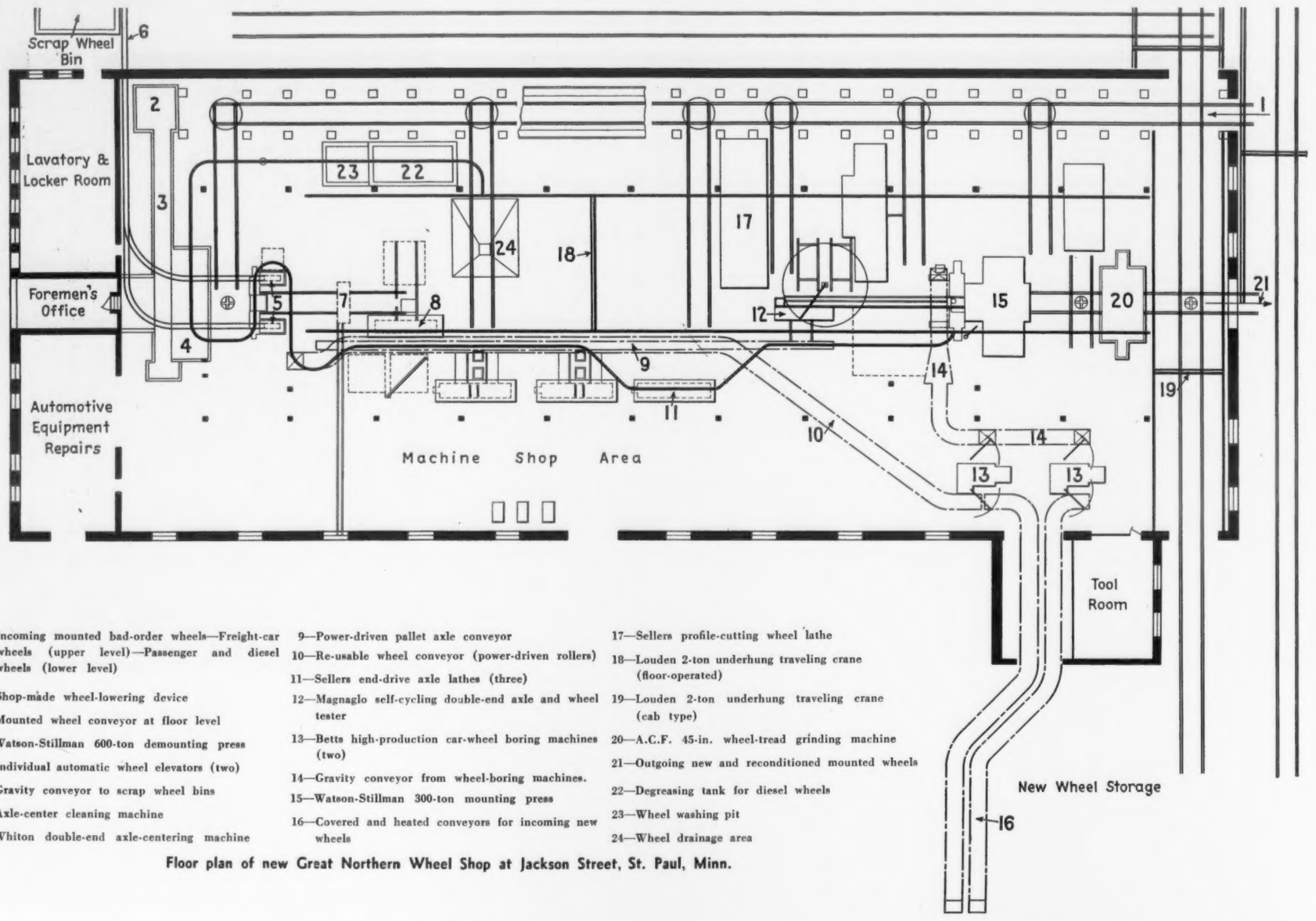
Each bad-order axle is raised by a floor air cylinder, electrically controlled and rolls into the cleaning machine *7*. After cleaning, it is kicked out and travels to the Whiton automatic cycling centering machine *8* and thence onto a pallet conveyor *9*. Axles may be handled on and off the pallet conveyor by the machinist who runs the centering machine, the machinists who run the Sellers end-drive axle lathes *11* or the Magnaglo machine *12*. The controls are electrically interlocked and any one of the above-mentioned mechanics can handle the axle, or number of axles into and out of his machine without leaving the machine. All axles after machining are rolled back on the pallet conveyor, inspected in the self-cycling Magnaglo machine, then sorted according to journal sizes and a list of sizes of wheel fits compiled and sent to the Betts boring mills *13*.

Wheels are bored to wheel-fit sizes and sent down a roller conveyor *14* to an automatic upender and pre-mounter, this being actuated when a pre-selected axle has been sent to the wheel press *15* on a self-powered transfer dolly. The operation of the upender and the transfer dolly is so timed that the pressman can mount one pair of wheels before another pair is pre-mounted waiting for him. The press-on press is a through-type with an oil-gear drive and electro-pneumatic control.

After the wheels are gaged, they roll along a track through the grinder *20*, about every fourth pair having the tread ground, as stated. These particular wheels are used on cars of Great Northern ownership. The wheels pass out of the shop at *21* and are double-deck loaded on wheel cars and sent to their respective destinations.

The shop is equipped with a large diesel wheel-cleaning tank *22* which uses C & H chemical solution at 200 deg. F. The wheels are washed at pit *23* and drained at *24*. Roller-bearing turntables require little effort to turn a pair of wheels for delivery to a number of accessory tracks in the shop. Two Yale 6,000-lb. fork-lift trucks are kept busy with miscellaneous lifting operations throughout the shop and an Orton 10-ton diesel crane equipped with a boom

Gravity roller conveyors take wheels to and from the two modern Betts wheel-boring machines.



1—Incoming mounted bad-order wheels—Freight-car wheels (upper level)—Passenger and diesel wheels (lower level)

2—Shop-made wheel-lowering device

3—Mounted wheel conveyor at floor level

4—Watson-Stillman 600-ton demounting press

5—Individual automatic wheel elevators (two)

6—Gravity conveyor to scrap wheel bins

7—Axle-center cleaning machine

8—Whiton double-end axle-centering machine

9—Power-driven pallet axle conveyor

10—Re-usable wheel conveyor (power-driven rollers)

11—Sellers end-drive axle lathes (three)

12—Magnaglo self-cycling double-end axle and wheel tester

13—Betts high-production car-wheel boring machines (two)

14—Gravity conveyor from wheel-boring machines.

15—Watson-Stillman 300-ton mounting press

16—Covered and heated conveyors for incoming new wheels

17—Sellers profile-cutting wheel lathe

18—Louden 2-ton underhung traveling crane (floor-operated)

19—Louden 2-ton underhung traveling crane (cab type)

20—A.C.F. 45-in. wheel-tread grinding machine

21—Outgoing new and reconditioned mounted wheels

22—Degreasing tank for diesel wheels

23—Wheel washing pit

24—Wheel drainage area

Floor plan of new Great Northern Wheel Shop at Jackson Street, St. Paul, Minn.

Power-operated transfer dolly which has just delivered an axle to the assembly position.

Outgoing track from the shop. Heppenstall tongs applied to lift a pair of wheels to the wheel car.

Wheels and axle ready to be assembled and rolled into the mounting press.

and electro-magnet loads out scrap car wheels.

Included in the revised shop facilities are a new foreman's office, a new lunchroom, locker and toilet room for the various workmen.

The shop is equipped with one 2-ton 29-ft. span underhung crane with floor control *18*, moving lengthwise of the shop, made by the Louden Machine Company, Fairfield, Iowa, and supplied by the Wm. H. Ziegler Company, Minneapolis, Minn. This crane is equipped with a hoisting unit made by Electro-Lift, Inc., Chicago, and arranged so it can operate when desired off the crane rail to the mono-rail system which in general extends in loops from the degreasing tank to the dismounting press, around the scrap wheel elevators and down the line of the axle conveyor with offset to only one of the axle lathes used mostly for passenger-car and diesel wheel work.

A second Louden 2-ton crane *19* with 17-ft. span and Yale & Towne electric hoist, but equipped with an operating cab, is installed transversely in the outgoing end of the shop and used for loading wheel cars. Two outside Chicago tram rail cranes with 40-ft. and 20-ft. spans for wheel handling are of 2-ton capacity and equipped with electric hoists supplied by the Chisholm-Moore Hoist Corp., Tonawanda, N. Y.

The pallet axle conveyor and roller-wheel conveyors used in the new wheel shop were manufactured to Great Northern specifications by the Standard Conveyor Company, North St. Paul, Minn. The two gravity roller conveyors *16*, on which new wheels enter the shop for boring, are enclosed and steam heated so that wheels will be at proper temperatures when they reach the boring mills.

The wheel upenders were designed and built by the Great Northern and utilize a series of interlocks, solenoids and electric stops, as well as air cylinders to up-end wheels and premount them on the axle prior to entering the mounting press.

The cranes use automatic lifting tongs supplied by the Heppenstall Company, Pittsburgh, Pa., and will not require the services of a hooker as the overhead craneman can hook onto the wheels and turn them at 90 deg. either for loading on wheel cars, or to unload onto the scrap wheel ramp.

A series of revolving brushes is located on the incoming bad-order wheel ramp, and distillate is circulated through a pipe system to the brushes and journals of the b.o. wheels as they roll along the ramp. Troughs catch the surplus distillate and return it to the pumps from whence it can be recirculated.

The hydraulic elevator of the 600-ton wheel press *4* travels 400 in. per min. to lower the wheels into the press

After mounting, the reconditioned wheels roll into and through an A. C. F. grinding machine.

and raise them back to floor level. By mounting this press on its side in the shop floor, the wheels can continue through and it is not necessary to reverse their direction. The machine has automatic cycling, a press-off speed of 32 in. per min. up to 400-ton, and 8 in. per min. up to 600 ton. It also has rapid traverse of 360 in. per min. The hydraulic equipment is oil gear and Vickers combination. The press is powered by a 50-hp. motor.

The elevator *2* which lowers the bad-order wheels from the storage ramp to floor level and transfers the wheels across the end of the shop and into the press-off machine, has been locally designed and built by Great Northern forces. The elevator and traverse mechanism can be actuated by the weight of a pair of wheels, but for exact spotting control, a small horsepower motor chain drives the mechanism. Electric stops and interlocks are so arranged that every time a pair of wheels is fed into the press-off machine, another pair of wheels is kicked into the elevator, while still another pair is traversed across the shop so that it can be fed into the press-off machine.

The two scrap wheel elevators *5* are push-button controlled and raise the wheels, as they come off the axles, 20 ft. overhead. The scrap wheels in turn run down a ramp *6* through an opening in the upper wall at the end of the building and outside the shop to bins approximately 50 ft. away. Air switches, which are manipulated by means of air solenoid valves, control the delivery of wheels to any one of four bins.

The Whiton centering machine *8* made by the Whiton Machine Company, New London, Conn., is a semi-automatic type with power-driven chucks built to Great Northern specifications and has automatic cycling heads. Axles are centered in this machine within an accuracy tolerance of .0025 in. from wheel seat in any direction and a tolerance of .015 in. in depth of center. The machine is complete with ways to roll the axle in, and an air-powered lowering and raising device which also kicks the axle out of the machine when the operation is finished. Each of the heads is powered with a 10-hp. motor.

The three axle lathes *11* are Sellers latest type dual-end-drive, with fillet-turning attachments, rollers and tool holders, and powered by variable-speed d.c. motors.

The Betts car wheel borers *13* are heavy-duty hydraulic-feed, equipped with anti-friction bearings for use with carbide tooling. Both borers have twin electric hoists to facilitate the handling of wheels.

The wheel lathe *17* to be installed is a Sellers 50-in. machine, powered by a 100-hp. motor and equipped for automatic profiling, with a built-in method of obtaining tape sizes. It has spring-loaded spindles to reduce the loading time so that the operator does not have to leave his station. The machine has a closed hydraulic system on the left head drivers with push button control, the operator pressing one button to traverse the right head, another button to chuck, and then is being ready to turn wheels. The machine is equipped to turn at a maximum speed of 24 r.p.m. The hydraulic equipment is Vickers. The machine has a vibrating chip pan to avoid the need of a helper in attendance at all times to remove chips.

The Magnaglo machine *12* has been rebuilt by the Great Northern to incorporate twin heads, an automatic feed and rejection system, also power turning of the axle for inspection. The headstocks have been raised so as to accommodate mounted wheels, and the cycling of the coils is automatic.

The car-wheel grinder *20*, furnished by the American Car & Foundry Co., has retractable heads. The grinder drive for revolving car wheels is mounted beneath the floor to permit the wheels to pass through when the grinder is not in use. The grinder is equipped with dual 50-hp. motors.

The 300-ton mounting press *15* is the inclined two-bar type complete with axle shifters and right and left automatic pusher blocks. The hydraulic rams are foot-controlled by electric-pneumatic switch. The press is a pass-through type and wheels can be gaged in any position.

In an attempt to more than meet A.A.R. standards of precision work and quality of finish, all key machines in the new Great Northern wheel shop are checked weekly to make sure they stay level and in adjustment. Axle lathe accuracy is kept to .001 in. in diameter with no tolerance for taper. Boring mills are held to .003 error in concentricity measured with a test wheel carefully ground all over.

All A.A.R. standard gages are used and checked periodically. Micrometer calipers, both dial type and direct-reading, are also checked for continued accuracy using standard micrometer gage blocks. Special gages for measuring journal length, collar height, wheel seat length and setting the heights of cutting tools are made easily available. Carbolloy insert cutting tools, supplied by the John C. Eide Company, Minneapolis, Minn., are used almost exclusively for machine tool operations in this shop. Tool inserts are accurately ground on an Anderson tool grinding machine using a small 6-in. diamond dust abrasive wheel. With tool and machine conditions maintained as nearly perfect as possible, tool breakage is minimized and high cutting speed with full accuracy assured.

Control of Corrosion in Locomotive Diesel Engines*

By A. C. Mengel

Chief Chemical Engineer, American Locomotive Company

Fig. 1—Early type of cavitation-erosion on diesel-engine cylinder line.

THE greatest single corrosion problem in steam locomotive operation was embrittlement of the boiler plate resulting from then-current methods of treating boiler feedwater to prevent scale formation. Scale formation, which of course was not a corrosion problem in itself, reduced the heat-transfer efficiency of the boiler, raised the temperature of the metal wall, and led to serious danger of overheating and failure. This problem of scale formation was first attacked many years ago by treating boiler feedwater with an alkaline material (sodium carbonate).

While the use of feedwater treated in this manner greatly reduced if not eliminated scale formation, the dissolved oxygen in the treated water made the boiler susceptible to pitting and corrosion, further aggravated by the absence of scale, which had previously served to protect the boiler surface from this type of attack. In order to prevent pitting, therefore, it was found that comparatively high alkalinity of feedwater was necessary (pH 9.6).

However, this solution raised a new corrosion problem. The alkaline water, without preventive chemicals, attacked the boiler shell at grain boundaries in highly stressed areas, following concentration of the alkalies in seams and at leaks. Cold working of the boiler shell and other parts apparently increased susceptibility to this type of attack. Locomotive failures due to this involved type of corrosive action caused considerable loss to railroads before the problem was solved.

The ultimate solution actually consisted of four preventive measures: (1) proper maintenance of sulfate-carbonate ratio; (2) maintenance of a ratio of sodium nitrate to alkalinity in feedwater; (3) use of steel of lower tensile strength in boiler construction, so that stresses at grain boundaries would be lower; and finally (4) adoption of the all-welded, stress-relieved boiler. Today the wide use of the "embrittlement detector" developed by the U. S. Bureau of Mines is of great assistance in further controlling embrittlement, not only in steam locomotive boilers but also in stationary boilers.

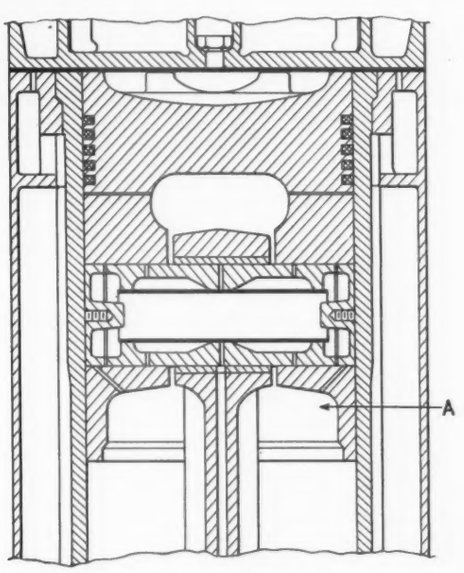


Fig. 2—Sections through cylinder of Alco six-cylinder diesel engine in locomotive service.

Embrittlement of the boiler plate had been such a vexatious problem that, although it was eventually solved, it hastened the general adoption of the diesel-electric locomotive in the United States.

* Presented at the Third Railroad Corrosion Conference, Harbor Testing Station of the International Nickel Company, Wrightsville Beach, N.C., May 6-8, 1952.

Fig. 3—Type cases of corrosion on cylinder liners. Liner at left shows retarded corrosion due to addition of chromates to cooling water; liners at right show advanced corrosion due to absence of chromates. Single notch in baffle used in both cases. Compare Fig. 5.

Fig. 4—Detail of same type of corrosion shown in Fig. 3.

Diesel-Electric Locomotives—Early Corrosion Problems

American Locomotive Company experience with diesel-electric locomotives goes back to 1924, when Alco built the first successful diesel-electric for railroad use—a 300 hp. switcher equipped with Ingersoll-Rand diesel engine and G.E. traction equipment. This was a six-cylinder, air-injection type with 14 in. by 16 in. cylinders. In 1928, when Alco acquired the McIntosh & Seymour diesel engine plant at Auburn, N.Y., this pioneer engine was replaced with a six-cylinder, 9½ in. by 10½ in. diesel rated at 300 hp. and 550 r.p.m. (later increased to 700 r.p.m. without supercharging). The following year the Auburn engineers initiated the design of a six-cylinder, 12½ in. by 13 in. diesel engine, developing 600 hp. at 700 r.p.m.; also without supercharging. These engines were installed in new locomotives then being built at Schenectady.

In 1935 Alco built its first supercharged diesel engine, which was placed in locomotive service in 1936. This was a six-cylinder, 12½ in. by 13 in. solid-injection engine supercharged to 900 hp. at 700 r.p.m. Later, about 1938, this design was increased to 1000 hp. at 740 r.p.m., while the unsupercharged diesel was increased to 660 hp. at 740 r.p.m. In 1943 the first Alco V-12 engines were built for test at Auburn and were later (1946) installed in locomotives for delivery to various railroads. In 1946 also appeared the Alco V-16 diesel engine, which, like the V-12, had 9 in. by 10½ in. cylinders.

As indicated above, the early diesel engines were of low horsepower, and successive types were increased in horsepower rating by supercharging. The supercharging was accomplished with practically no change in the cooling systems, except to increase the velocity of the cooling water.

Corrosion in Alco diesel engines was first evidenced by pitting and formation of ferric hydroxide on the cylinder-liner surfaces. This naturally caused concern, but did not result in engine failure. The first failures of liners to come to our attention at Alco were due to what would be called "cavitation erosion" today (Fig. 1). This action occurred at the upper end of the liner, just beneath the port into the cylinder head. The water, used without treatment, had a pH of about 6.2 to 6.5. At that time, it should be noted, chromates were not available as they are today.

About 1939, in order to improve cooling of engines, Alco designed a cylinder block containing a baffle which was located in the area designated by the letter A in Fig. 2. One notch on this baffle permitted water to flow

to the upper compartment. After about a year of field operation with this baffle, Alco began to receive reports of corrosive attack on cylinder liners. This type of attack, which resulted in perforation of the liner, was quite new to us at the time. Typical cases of this type of corrosion on actual cylinder liners are shown at the right in Fig. 3. A close-up detail of the same type of corrosion is shown in Fig. 4.

Methods Used by Alco to Combat Cylinder-Liner Corrosion

Because of the considerable number of diesel-electric locomotives involved in this type of corrosion, the Alco laboratory at Schenectady undertook, in 1940-1941, a planned research program, beginning with attempts to reproduce this form of attack in the laboratory. Tests of from four to six weeks' duration were carried out. Water with all conceivable conditions of pH, oxygen saturation, deaeration, hardness, velocity, temperature, and jet action were used. Although we had high and low corrosion rates in these tests, we could not produce the type of attack characteristic of the failures reported by the railroads.

At this point, a brief review of liner conditions after failure may be of interest. Alco's first observation was that there was no calcium carbonate scale on liner surfaces where pitting and corrosion had occurred extensively. A drop of dilute hydrochloric acid produced no effervescence. In this regard, we had studied at one time the application of calcium carbonate to the cooling systems to build up a protective film on liner surfaces.

The second observation was that, while total carbon of drillings from corroded liners was about 3.16 per cent, the total carbon values of the honeycombed areas around the point of failure were about 2.65 per cent. Apparently graphitic carbon was removed faster from liner surfaces than was the cast iron itself.

Use of Chromates in Diesel Radiator Cooling Water

Attempts to reproduce cylinder-liner corrosion failures in the laboratory were abandoned after about 15 months of work. Our conclusions were that there were conditions present in diesel locomotive engines that could not be duplicated in bench type laboratory tests. The author suspected that there were hoop type stresses which projected action (probably similar to hydraulic action) against liners in the region close to the notched hole in the baffle referred to above.

During this period, while the laboratory was attempting to duplicate the corrosive action observed in the field, Alco's engineering department had increased the number of holes in the baffle, thus reducing the water velocity at the notch. This change in baffle design was made in 1941.

At about the same time, both laboratory and engineering departments concluded that treatment of the water with chromates was the only solution to cylinder-liner corrosion, and had convinced the various railroads to this effect. (Fig. 5 shows the effect in reducing corrosion by adding chromates without increasing the number of holes in the baffle. Compare with Fig. 3, right, which shows extent of pitting and honeycombing due largely to impingement of water *without* chromates added.)

These two measures—reducing the velocity of the water by mechanical means, and treatment of the water with chromates—resulted in great reduction of corrosion, and the laboratory's work in this direction was considerably lightened. Shortly thereafter several technical papers were published which indicated that the observed type of corrosion-erosion could be reproduced by high-frequency vibrations of test specimens in water.

Fig. 5—At left the cylinder liner shown in Fig. 3. Without change in baffle design, corrosion was retarded solely by addition of chromates to cooling water, with water velocity remaining constant.

As has been pointed out by Wilkes* and others, chromate type corrosion inhibitors protect metal surfaces from corrosion through electrochemical and mechanical action. This action is explained as follows: "Bright iron surfaces exposed to air immediately form invisible oxide films, which are relatively porous. When water contacts the iron surface, ferrous ions seep outward through the pores of the oxide film and combine with hydroxyl ions in the water, forming ferrous hydroxide. Once in solution, the iron eventually precipitates as an insoluble ferric hydroxide sludge. When alkali chromates are present in the cooling water, ferrous ions starting outward through the pores interact with chromium ions to form a mixed precipitate of ferric hydroxide and chromium hydroxide. This co-precipitate forms in the pores of the iron oxide film, sealing the pores and effectively stopping solution of iron.

"With proper chromate concentrations, the protective film is virtually continuous and uniform over the surface of the metal. The film may be cracked and removed by stresses, or by scouring action of water at points of high liquid velocity, but will continuously repair itself, if the chromate concentration in the cooling water is maintained sufficiently high in relation to other salts. However, if the chromate concentration is not sufficient to produce a blocking mixture in the oxide film pores, but merely causes precipitation of mixed oxides in the form of a loose, visible blister which does not contact the metal surface, the inhibitor may be excluded from susceptible corrosion spots, allowing accelerated corrosion to proceed beneath the film."

Alco's first recommendation for use of chromate was

* J. F. Wilkes, Water Conditioning for Diesel Cooling Systems, Southern Railway Diesel Club, Dallas, Tex., Meeting, October 10, 1950.

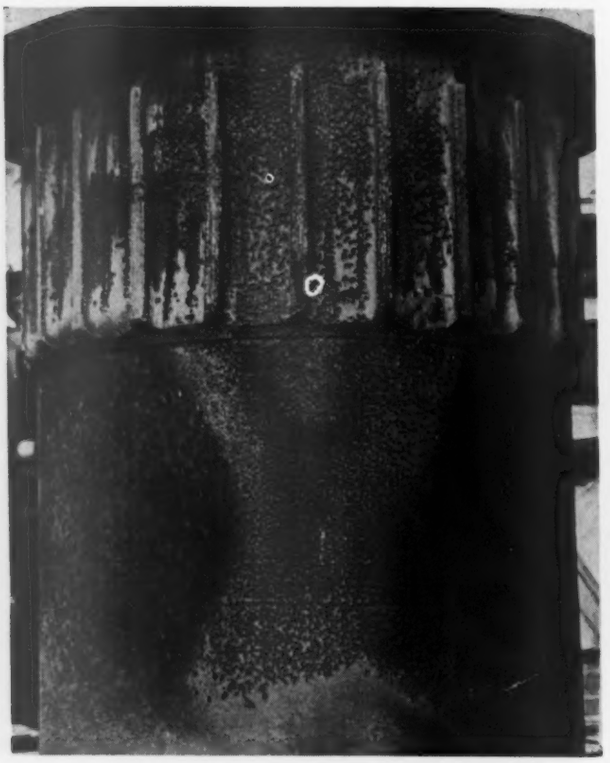


Fig. 6—Extent of cylinder-liner corrosion possible without chromate treatment after approximately 70,000 miles of service in diesel-electric locomotive.

that 500 parts per million should be sufficient. No particular reference was made to pH factor. However, because of difficulty experienced by railroads in maintaining this concentration (due to leaks, etc.), the figure was increased to 1,000 ppm. This concentration was again increased to 2,000 ppm minimum when Alco brought out the 9 in. by 10½ in. V-12 diesel engine for locomotive use in 1946, the pH then being from 8.5 to 9.5.

At first there were many instances of complaints that cylinder-liner corrosion continued to exist despite careful control of chromates. Gradually, as more and more precise control was achieved by the various railway systems, these complaints decreased in frequency until such instances today are quite rare indeed.

Alco's years of experience in this field indicates that if corrosion occurs with the use of chromate, the reason is that control of chromate has been allowed to lapse. Forty-eight hours with low chromate or no chromate at all can result in corrosion of consequence. Fig. 6 shows the extent of corrosion possible without chromate treatment after approximately 70,000 miles of service.

Alco is constantly aware of the importance of using only chromate-treated water in the cooling systems of new diesel locomotives, and provides chromate-treated water for break-in testing of all its diesel engines. The company has also set up two treating stations in its diesel locomotive shops so that only properly treated water can be used to fill cooling systems of new locomotives. In addition, Alco checks chromate content of water in systems of new locomotives immediately prior to shipment. All these precautions are of vital importance, for unless chromate control is maintained from the very beginning, corrosion of cylinder liners may become initially established in the form of pitting of the liner. It is much more difficult, once this has happened, to provide subsequent corrosion protection with chromates. Accordingly, the railroad's maintenance personnel should make every effort to provide continuous chromate protection from the moment of delivery of the new locomotive.

Precautions To Be Observed in Handling Chromates

The active agent in corrosion-inhibiting cooling fluids of the chromate type is sodium bichromate, which is present in the treated radiator water in about .20 per cent concentration. It is the only successful corrosion preventive in use at the present time on diesel-electric locomotive cooling systems, and will probably continue in use for a good while. Among its advantages are (1) gives visual evidence of presence in water; (2) the concentration of chromate is easy to determine and control; (3) it is inexpensive; (4) it produces the required results.

However, chromates have one important disadvantage in that they require careful handling because of their toxicity. The *Journal of the American Medical Association* for November 17, 1951, reported that "chromate dermatitis, resulting from contact with diesel locomotive radiator fluid, constitutes an industrial hazard of growing importance in the railroad industry. Its occurrence should be brought to the attention of industrial surgeons, dermatologists, and safety engineers, so that it may be promptly recognized and proper preventive and protective measures instituted."

In the Alco shops at Schenectady and Auburn, N.Y. we had some experience with chromate dermatitis in the early days following its introduction. Once the condition was recognized and the dermatitis treated medically, the hazard was immediately corrected. Safety measures included a short course of training for operators handling the chromate, provision of better equipment and working conditions, and facilities for washing in close proximity to the working area. Manufacturers of chromates have published safety recommendations which are readily available and which have proven very effective not only in handling chromates but also in the large-scale handling of much stronger concentrations than those encountered in railroad work.

In addition, measures have been taken by chromate manufacturers to reduce the dust hazard by producing the chemical in the form of pellets or cubes. At least one manufacturer has available automatic treating stations from which only properly treated water can be taken, thus greatly minimizing problems of handling. These plants are simple, low-cost adaptations of wayside feeders used so successfully in steam locomotive service. A short course of lectures to people handling this chemical should also prove very helpful. Alco laboratory workers, with proper instruction and the exercise of common cautions, handle much more toxic chemicals every day with no difficulty whatever. Railroad shop personnel, unless there is extreme hypersensitivity or pre-existing allergy, can, it is felt, handle chromates with complete safety.

In closing, it may be added that all of the present producers of corrosion-inhibiting cooling fluids are at present studying and making tests of alternate materials that can be substituted for chromates in the event that either the supply of chromates may be curtailed in the foreseeable future, or that the problem of toxicity may become serious enough to warrant use of a substitute for chromates. At the present time, however, there is no definite indication that either of these eventualities will materialize.

Diesel freight west of Glenwood Springs, Col.

D.&R.G.W. Increases Operating Efficiency with Diesels

Effective use of new power on this road is largely due to controlled lubrication and good maintenance

No SMALL part of the credit for an operating ratio of 67 per cent on the Denver & Rio Grande Western in 1951 is due to the successful use of diesel motive power, made possible by effective maintenance, controlled lubrication and close operating-mechanical teamwork. As of January 1, 1952, the diesel locomotive inventory included 40 switchers, 9 road-switchers, 30 four-unit and 2 three-unit road locomotives, a total of 81 locomotives, or 175 units. A number of units are equipped with steam generators and used in passenger service when necessary. Thirty-six new EMD diesel units are expected to be delivered by the middle of the year.

Operation in the mountainous country traversed by this railroad, with mainline elevations up to 10,221 ft. at Tennessee Pass, maximum grades of 2, 2½ and 3 per cent, tunnels galore culminating in Moffat, and multitudinous curves up to 12 deg. presents difficulties and costs in no way comparable with those of more level roads. One of the principal contributions of the diesel locomotive has been its ability to handle increased tonnage from one end of the line to the other with minimum helper service and no stops at 15-mile intervals for wheel-cooling on down grades such as were required before the advent of dynamic brakes.

As a matter of fact, the diesels now take safely down hill at reasonable speeds at least as much tonnage as they can haul up. Freight trains delivered to the D.&R.G.W., possibly by three-unit diesels, are handled over the system by four-unit locomotives with one or more helpers cut in usually at only two points, eastbound or westbound, namely, grades to Soldier Summit in Utah, and either Tennessee Pass or Moffat Tunnel, Colo.

Helper service is supplied by 1,500-hp. road switchers and three- or four-unit diesels as required by train length

On the main line at Thistle, Utah, between Price and Provo

and grade, also by some steam locomotives. As many as six or seven diesel units are often double headed in pulling trains up hill, but when more power is required, one four-unit locomotive is operated at the head end, another is cut in about 25 cars back and, if the tonnage or severity of the grade makes it necessary, still another, or a steam locomotive, may be cut in just ahead of the caboose.

D. & R. G. W. SYSTEM FREIGHT-TRAIN PERFORMANCE

	1951	1950	1948	1941*
Freight train-miles	4,037,986	4,067,534	4,739,257	4,696,283
Gross ton-miles produced (000)	12,015,591	10,355,365	10,841,180	8,387,748
Net ton-miles produced (000)	5,782,825	5,066,955	5,387,026	3,585,858
Average train speed, m.p.h.	17.1	17.0	16.5	16.5
Average gross train load, tons	2,976	2,546	2,288	1,786
Gross ton-miles per train-hour	50,847	43,276	37,848	29,542

* Includes the former Denver & Salt Lake Railway Co.

PERFORMANCE OF DIESELS IN FREIGHT SERVICE, WEEK ENDED FEBRUARY 24, 1952

	Excluding units held	Including units held
Average number of locomotives in service	26.1 ss	27.9
Potential hours	4,380	4,686
Mechanical time held, hr.-min.	423-5	729-5
Time available, hr.-min.	3,956-55	3,956-55
Per cent availability	90.3	84.4
Time available not used, hr.-min.	283-30	283-30
Time used, hr.-min.	3,673-25	3,673-25
Per cent utilization	83.9	78.4
Per cent used of hours available	92.8	92.8
Unit time out of service, hr.	648	.....
Unit miles lost	8,885	.....
Total locomotive miles	60,099	.....
Average miles per day	8,585	.....
Average miles per day per locomotive	329	.....

Improvements in diesel locomotive engine and electrical equipment, plus the application of radiator water spray systems for engine cooling in tunnel operation, permit handling more tonnage and at lower speeds on grades than was formerly practicable. At one time, one four-unit diesel would move 1,800 tons westbound out of Denver up the 2 per cent grades to the Moffat Tunnel, but this train load has now been stepped up to 3,400 tons and the minimum continuous safe speed on grades without traction motor overheating has been decreased from 14 m.p.h. to 10.5 m.p.h. Westbound trains out of Pueblo are operated up to 4,800 tons.

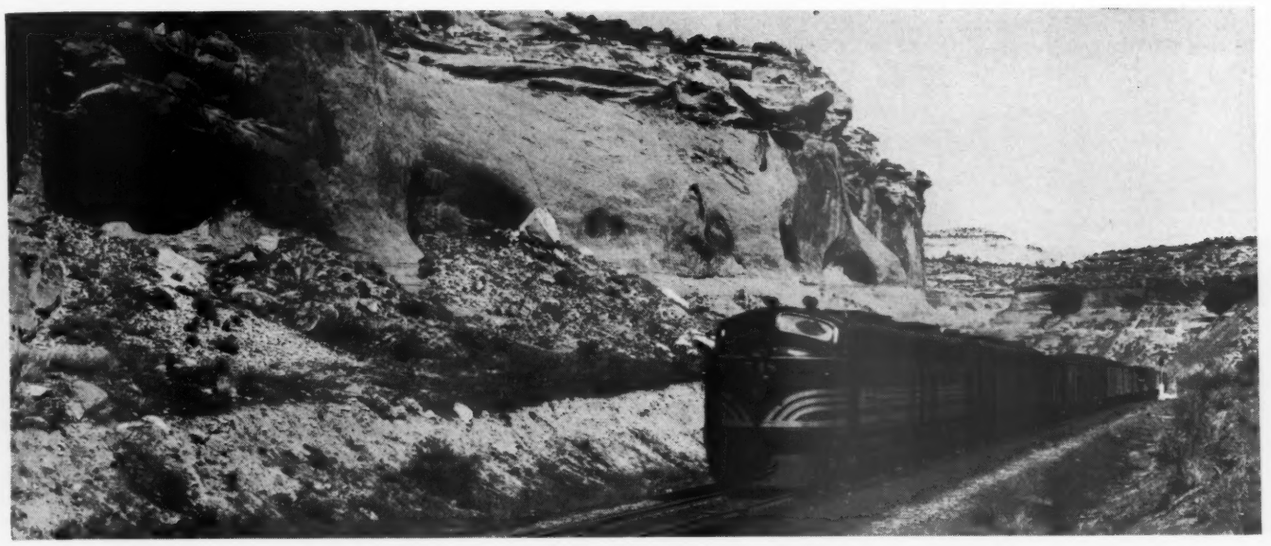
Eastbound via Denver, 5,000-ton trains are handled over the road with helper service for a total of only 38 out of 570 miles. On one day recently, an average of 112 cars per train were handled on the Salt Lake Division, and the average for the system in both directions was 84 cars. During February the average train load for the system was 3,199 tons and the gross ton-miles per train hour 51,785, a continued improvement over exceptionally favorable operating results in 1951.

Record Operating Results

As shown by a table in its annual report the D.&R.G.W. made the greatest improvement in freight train performance during 1951 of any year in the history of the company. Whereas freight-train miles decreased 14.0 per cent from the 1941 figure, gross ton-miles increased to over 12 billion, reflecting a 43.3 per cent increase in volume of business handled. Net ton-miles followed a similar pattern. The average gross train load increased 66.6 per cent over 1941 to 2,976 tons in 1951, and this in spite of a slight stepping up of average train speeds to 17.1 m.p.h. The result was an increase in gross ton-miles per train-hour from 29,542 in 1941 to 50,847 in 1951, or 72.1 per cent, an accomplishment largely attributable to diesel power which hauled 83.0 per cent of the tonnage last year.

Three tables showing diesel performance in road-freight and helper service, also shopping time and terminal delays for the fairly typical weekly period ended at 11.59 p.m., February 24, further confirm the effective use being made of diesel power on this road. With an average of 26.1 four-unit freight diesels in service, the ratio of hours available for operation to total hours in the period was 90.3 per cent and the ratio of hours actually used to total hours was 83.9 per cent. Even including units held out of service for one reason or another these percentages dropped to only 84.4 and 78.4 respectively.

The D.&R.G.W. tries not to fool itself with misleading statistics, hence the insistence on including in utilization figures freight units held out of service for repairs or other reasons. Accurate records are kept of all hours locomotives are not available for service and unit miles lost.



In Ruby Canyon near the Colorado-Utah state line

COST OF DIESEL LOCOMOTIVE REPAIRS—CENTS PER MILE

	1951	1950
January	48.76	37.41
February	34.34	43.73
March	40.34	38.10
April	38.22	39.64
May	39.82	34.09
June	41.01	31.87
July	36.18	42.43
August	37.07	40.57
September	36.15	34.65
October	37.32	39.60
November	38.98	39.01
December	48.88	50.22
Average	39.76	39.35

UTILIZATION OF GP (GENERAL PURPOSE) DIESELS, WEEK ENDED FEBRUARY 24, 1952

	Roper-Helper, Utah	Burnham-Phippsburg, Colo.
Locomotives in service	2	7
Potential time, hr.	336	1,176
Mechanical time held, hr.-min.	38-45	105-45
Time available, hr.-min.	297-15	1,070-15
Per cent availability	88.5	91.0
Time available not used, hr.-min.	8-30	235-50
Time used, hr.-min.	288-45	834-25
Per cent utilization	85.9	71.0
Per cent used of hours available	97.1	78.0

DIESEL LOCOMOTIVE DETENTION AT TERMINALS, WEEK ENDED FEBRUARY 24, 1952

Terminal	Loco-motives	Mech. delay Hr.-Min.	Trans. delay Hr.-Min.	Average per locomotive Mech. Hr.-Min.	Trans. Hr.-Min.
Burnham	48	258-15	113-35	5-23	2-22
Pueblo	35	41-20	78-20	1-11	2-14
Grand Jct.	39	78-25	69-15	2-01	1-47
Salt Lake	38	45-05	22-20	1-11	0-35

Total locomotive miles in the period mentioned equalled 60,099, giving an average per day of 8,585 and average per locomotive per day of 329. Freight locomotives worked the equivalent of 50 days in local and helper service during this period and made 9,454 miles, all included in the total mileage mentioned. Deducting these leaves an average of 18.9 locomotives making 383 miles a day in through-freight service.

The table of terminal delays in the week ended February 24 shows delays due to mechanical work varying from 1 hr. 11 min. to 5 hr. 23 min. at four major terminals, also transportation delays at these four points ranging from 35 min. to two hr. 22 min. Needless to say this table is watched carefully by supervisors in both departments as well as top railway management.

A fourth table covering GP (general-purpose) diesel locomotive performance in helper and local freight service during the week ended February 24, also discloses the highly creditable figures of 88.5 per cent availability and 85.9 per cent utilization of two locomotives in helper and switching service and 91 per cent availability and 71.0 per cent utilization of seven locomotives in local freight service. The last two figures of 97.1 per cent and 78.0 per cent in the table reflect the success or difficulty of the operating department in using all of the locomotive service hours placed at their disposal by the mechanical department. D.&R.G.W. experience indicates that it is possible to get only about one-half as many miles per week or month with helper locomotives as with those used in through-freight service. This is approximately true with GP locomotives hauling local freight.

Business Volume Vital Factor

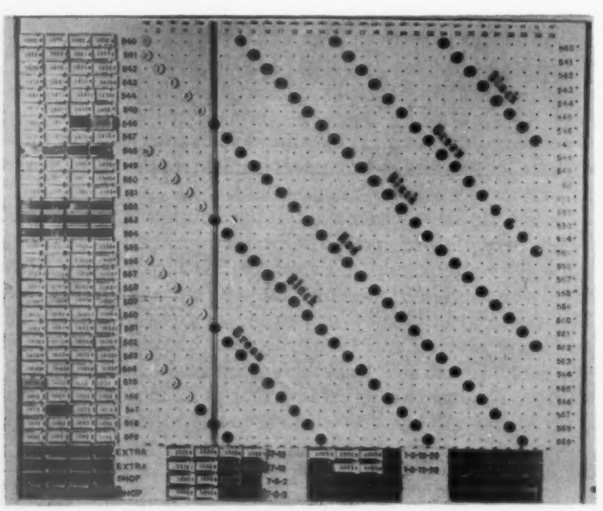
The close interdependence of operating efficiency figures and tonnage available for movement is again demonstrated by D.&R.G.W. records. In the week ended August 20, 1951, for example, only 1,120 unit miles were lost and the miles per locomotive per day in through-freight service averaged 397. In explanation: "This performance, far above any previous record, was brought about by having business available at all terminals with very little delay awaiting traffic to move." Conversely, a less favorable showing in the more recent week ended March 17 elicited the following statement: "Performance was adversely affected by a sudden drop in through business during the week, making it necessary to divert diesels to more locals, drag trains and helper service."

As previously suggested, the kind of country a railroad operates over has an important influence on operating costs and performance, and the D.&R.G.W. is no exception to this rule. Consequently any comparison with less mountainous roads, based on 1,000 gross ton-miles of freight traffic handled, fails to take into account the fact

DIESEL FREIGHT SERVICE—OPERATING COMPARISON, 1951

	First quarter		Second quarter		Third quarter	
	D. & R.G.W.	Average all roads*	D. & R.G.W.	Average all roads*	D. & R.G.W.	Average all roads*
Operating Costs and Consumption per 1,000 G.T.M.						
Operating costs in cents:						
Repairs	17.07	11.49	14.17	11.58	12.05	11.47
Fuel	24.81	17.17	22.89	16.63	22.03	16.15
Lubricants	1.50	.90	1.37	.86	1.44	.88
Total	43.38	29.56	38.43	29.07	35.52	28.50
Consumption in gallons:						
Fuel	2.60	1.82	2.40	1.75	2.31	1.71
Lube	.025	.017	.022	.016	.022	.017
Operating costs and Consumption per Unit Mile						
Operating costs in cents:						
Repairs	12.65	12.82	11.23	13.12	9.60	13.09
Fuel	18.38	19.18	18.13	18.70	17.56	18.64
Lubricants	1.11	1.02	1.08	.96	1.15	1.02
Total	32.14	33.02	30.44	32.78	28.31	32.75
Consumption in gallons:						
Fuel	1.93	2.02	1.90	1.95	1.84	1.93
Lube	.018	.019	.017	.018	.018	.019

* As taken from Report, prepared by EMD.



Thumb-tack colors:

Black — Weekly inspections
Green — Semimonthly inspections
Red — Federal inspection
White — Work completed

Diesel locomotive control board or maintenance calendar

that this heavy tonnage of load and equipment has to be moved around many sharp curves and lifted over one or more mountain ranges.

This statement is borne out by operating comparison reports which show D.&R.G.W. performance to be below average in gross tons hauled per unit and practically all items of cost per 1,000 gross ton-miles, but definitely above average in locomotive utilization and almost all costs per unit mile, or per gallon of fuel consumed. For example, in the third quarter of 1951, the gross tons per unit on the D.&R.G.W. were little more than three-quarters of the general average; the cost of repairs, fuel and lubricants per 1,000 g.t.m. was 35.52 cents compared with 28.50 cents average for all roads.

On a unit-mile basis, for the same period, however, the cost of repairs, fuel and lubricants was only 28.31 cents for the D.&R.G.W. compared with a national average of 32.75 cents. The consumption of fuel per unit mile on the D.&R.G.W. was 1.84 gal. compared with an average of 1.93 gal.; and lube oil, .018 gal. compared with .019 gal.

Without an effective diesel locomotive inspection and maintenance schedule, the motive power results described could not have been achieved. The program for this work follows closely recommendations in EMD pamphlet No. 1704, Revision L, and both operating and mechanical forces work together not only in using the locomotives intensively but making periodic inspections and repairs essential for this modern motive power to meet the exacting demands made upon it.

The principal departure from general practice in D.& R.G.W. diesel maintenance methods is the use of a spectrograph in the central laboratory at Denver to analyze crankcase oil and disclose mechanical conditions which need correction and, in fact, tell when oil changes are necessary. Drain periods have been extended to 300,000 and 400,000 miles or more with no apparent ill effects and, in fact, more reliable service, reduced maintenance and large savings in lubrication costs.

The D.&R.G.W. has pioneered not only in use of the spectrograph which gives a qualitative and quantitative analysis of lubricating oils, but has only recently installed at the Denver laboratory the first railroad-owned electron-microscope for research in (1) improved and less costly diesel locomotive fuels and dispersants, (2) lubricating oil types and additives which last longer and permit less engine wear, (3) acceptance testing of both fuel and lubricating oils on delivery.

The diesel control board or maintenance calendar, illustrated, is the basic device used in telling when diesel locomotives are due for inspection and repairs. In the D.&R.G.W. locomotive numbering system, the first three digits generally give the locomotive number and the fourth digit the unit number. Removable colored thumb tacks are inserted in the master board to show the dates when individual locomotives and units are due for various types of federal inspection such as monthly, quarterly, semi-annual and annual. In addition, there is a form DM-1 showing work to be done in short point checks of through engines, a slightly longer DM-2 daily or point check, DM-3 weekly inspection work order and DM-4 intermediate or semi-monthly work order. The DM-1 form is illustrated and a separate table shows individual items requiring annual attention.

Red thumb tacks indicate federal inspection dates and call for locomotives to be tied up at the assigned terminal before 6:00 a.m. of the date due. Green tacks indicate

semi-monthly inspections and the work may be done on the date due or one day before or after. Black tacks show weekly inspections. White thumb tacks with the initials of the various inspection points are inserted in the board in place of the colored tacks as soon as word is received that the work has been done. For instance, work called for on locomotive four-unit diesel locomotive No. 567 was done on the fifth of the month at *J*, or Grand Junction as scheduled. Other initials shown on the board include *B* for Burnham (Denver) and *SL* for Salt Lake.

Government inspection requirements are on a time basis and other maintenance is tied to this schedule. Oil changes are made only on laboratory instructions, and at such times locomotive units are held until difficulties are found and corrected. With this procedure, many original cylinder liners and crankshafts are running well in excess of 1,000,000 miles.

The principal point for annual federal inspections and heavy diesel repairs is at the Burnham shops where two units are generally worked on at one time. The effort is to keep a stable force so as to hold experienced diesel mechanics and electricians on this work. Spot, daily and weekly checks of locomotive conditions are made at engine terminals in Denver, Grand Junction and Salt Lake, two passenger locomotives and freight helper diesels being maintained at the latter point. Intermediate inspections are largely handled at Salt Lake.

In general, the endeavor is made to keep all units of a diesel locomotive together during operation, inspection and repairs, but this is not always possible and the flexibility of being able to substitute one unit for another is an important advantage of this type of power. With about 30 diesels to be handled in a 30-day month at each of three points on the D.&R.G.W., the various colored thumb tacks follow quite a uniform pattern at a 45-deg. angle down across the board which means fairly uniform work throughout the month. This result was not achieved at a moment's notice and is still subject to occasional upsets. Experience has shown how to prevent bunching too many similar operations in one shop on the same day.

Another thing carefully watched is not to mix up the locomotive types any more than necessary in any one shop. For example, FT diesels are generally handled in the first 11 days of the month, F3 locomotives the next 10 days and F7 locomotives in the last 10 days. Steam-generator repairs are concentrated in middle of month.

The inspection and maintenance schedule is relatively simple in use, requires little clerical work and can be easily kept up to date. Mimeograph reproductions of the schedule are available for the general office use, master mechanics, dispatchers and enginehouse clerks who telephone necessary information to the general office as required. Log books carried on the lead locomotive units contain a record of information especially helpful to repair men at terminals where the units are maintained.

Form DM-1
12-51

THE DENVER AND RIO GRANDE WESTERN RAILROAD COMPANY

Lead "B" "B" Trailing

ALL UNITS

LOCATION _____ DATE _____

SHORT - POINT CHECK - THRU ENGINES - EMD FT-F3-F7-GP7, ALCO 2000-1600 HP

TIME CARD CHARGE CODE		WORK DONE OR CHECKED BY
F	1. Fuel oil supply.	
W	2. Engine cooling water supply.	
S	3. Speed recorder tape marked and tape supply.	
C	4. Cab and windows clean.	
S	5. Cab drinking water and ice supply.	
S	6. Flagging equipment.	
L	7. Engine lubricating oil level and pressure.	
S	8. Sand supply checked.	
M	9. Visual inspection made of running gear - both sides.	
M	10. Air box drains checked for any unusual discharge (EMD).	
M	11. Sander operation checked.	
M	12. Drain main reservoir and auxiliary reservoir.	
M	13. Remove work report and check log book and sign for work done.	

APPROVED _____
Foreman

Explanation of Time Card Charge Code:

Code	Make Charge on Time Card, as Follows:
C	Clean Diesels
F	Fuel Diesels
L	Lubricate Diesels
M	Inspect and Repair Dieselse
S	Supply Diesels
W	Water Diesels

* All items with "F" Code should be charged direct to Diesel Unit Number.

Short form recording inspection of diesel power at intermediate points.

INDIVIDUAL ITEMS IN ANNUAL INSPECTION WORK ORDER FOR EMD FT, F3, F7 AND GP7 DIESELS—INCLUDES, IN ADDITION, DAILY, MONTHLY, QUARTERLY AND SEMI-ANNUAL WORK

1. Clean and paint all exposed wiring.
2. Clean main generator string band and riser—repaint.
3. Clean and check all magnet valves and air engines.
4. Lubricate reverser bearings and gear rack.
5. Clean and test dynamic brake grids.
6. Check pick up and drop out valves of relays in automatic transition circuits.
7. Check wheel slip and ground relay operation.
8. Flush diesel engine cooling systems.
9. Change out all cooling-system rubber hoses.
10. Apply 10-lb. water test on cooling system.
11. Calibrate speed recorders.
12. Check crankshaft end play.
13. Check main generator, compressor and fan drive alignment.
14. Check alignment of air-compressor gear couplings.
15. Inspect and clean air-compressor valves.
16. Remove and inspect connecting-rod bearings.
17. Magnaflux connecting-rod baskets.
18. Tighten and rewire connecting-rod basket bolts.
19. Check back lash of cam-shaft gear train.
20. Clean oil-separator elements.
21. Check trucks for wear.
22. Inspect lube-oil relief valves for stem shoulders.
23. Remove, clean and test oil-cooler core elements. (This work to be done annually or at engine changeout.)
24. Clean main-reservoir air filters.
25. Hydro and hammer main reservoirs, auxiliary water tanks and radiator spray tanks.
26. Change main-reservoir cut-off valves.
27. 24 RL air-brake equipment (sign for applicable items):
    Change automatic and independent brake valves.
    Change signal reducing valves.
    Change 21-B magnet valves—when used (F3's only).
    Change FA-4 magnet valve.
    Change master controller—when used (F3's only).
28. 8 EL air-brake equipment:
    Dead-engine fixtures when used.
29. Drain oil and flush system. (Note: See chemist.)
30. Lubricate air cylinder on reverser, cam-switch, braking and traction-motor contractors.
31. Lubricate compressor unloader. (All metal type.)

STEAM GENERATOR ONLY

32. Descale water-supply tanks and suction lines.
33. Overhaul water and circulating pump.
34. Overhaul water bypass regulator.
35. Overhaul servo control.
36. Test solenoid and relay coils with megohmmeter.
37. Test ignition transformer with megohmmeter.
38. Hydrostatic test.
39. Repack and test separator blowdown valve.
40. Clean and inspect blower fan bearings.
41. Overhaul motor converter and inspect sealed bearings.
42. Overhaul rotary converter.
43. Inspect and test coil blowdown valve.
44. Inspect coil retainer and pads.
45. Replace fusible metal slug in high-temperature switch.
46. Replace helix in stack switch and test.
47. Overhaul air filter.
48. Overhaul air-reducing valve.
49. Overhaul gear reducer.

Diesel-Electric Locomotive Units In Railway Service

AMERICAN railways added 3,624 diesel-electric locomotive units to their rapidly expanding fleets during 1951. Of these, Class I railroads added 3,463 units and 5,119,150 horsepower to chalk up an expansion of nearly 25 per cent in the number of units and nearly 28 per cent in total horsepower over the inventory of the previous year.

The nation's railways entered 1952 with a total of 18,964 diesel-electric locomotive units. Of these, 17,610 units, representing 23,561,137 horsepower, comprised the power of Class I line-haul railroads and compared with 14,147 units aggregating 18,432,487 horsepower as of December 31, 1950. This increase included 11 units of 2,500 hp.; 20 units of 2,400 hp.; 136 units of 2,250 hp.; 35 units of 2,000 hp.; 687 units of 1,600 hp., and 1,835 units of 1,500 hp.

At the end of 1951 switching and terminal companies and Class II and III railroads owned 1,354 diesel-electric locomotive units with a total of 1,239,290 hp.

Diesel-electric locomotive units in service on Class I line-haul railroads (excluding switching and terminal companies), as of December 31, 1951, were as follows:

Number of Units	Horsepower Each Unit	Total Horsepower
36	3,000	108,000
42	2,400–2,500	103,000
255	2,250	573,750
1,310	1,800–2,000	2,613,400
965	1,600	1,544,000
7,469	1,500	11,203,500
1,173	1,350	1,583,550
6,360	1,200 or less	5,831,937
Total 16,610		23,561,137

A similar tabulation was published in the May 14, 1951, *Railway Age* and the May 1951 *Railway Mechanical and Electrical Engineer* for 1950.

DIESEL-ELECTRIC LOCOMOTIVE UNITS IN SERVICE ON CLASS I RAILROADS

Excluding Switching & Terminal Companies—As of December 31, 1951

Railroad	Number of Units in Various Horsepower Classes*								Total	
	3000	2400 or 2500	2250	1800 or 2000	1600	1500	1350	1200 or less	Units	Horsepower†
Akron, Canton & Youngstown	....	....	....	5	3	1	....	2	11	18,300
Ann Arbor	....	....	....	....	14	....	....	9	23	28,720
Atlanta & St. Andrews Bay	....	....	....	....	....	1	....	12	13	13,500
Atlanta & West Point—W. of Ala	....	....	....	....	....	14	....	7	21	28,200
Atlantic & Danville	....	....	....	....	1	6	....	....	7	10,600
Atchison, Topeka & Sante Fe	....	....	....	66	19	511	320	256	1,172	1,605,530
Atlantic Coast Line	....	....	5	59	....	302	72	107	545	801,050
Baltimore & Ohio	....	....	8	44	10	272	24	239	597	793,660
Bangor & Aroostook	....	....	....	2	....	32	....	4	38	56,000
Bessemer & Lake Erie	....	....	....	....	....	31	....	2	33	48,030
Boston & Maine	....	....	1	21	....	34	68	71	195	239,550
Cambria & Indiana	....	....	....	....	....	....	....	2	2	2,400
Central of Georgia	....	....	2	10	....	41	....	25	78	107,980
Central of N. J.-Cent. of Pa	....	....	....	6	16	44	....	60	126	160,060
Central Vermont	....	....	....	....	....	....	....	4	4	4,000
Charleston & W. Carolina	....	....	....	....	....	27	....	2	29	42,900
Chesapeake & Ohio, incl. P. M.	....	....	22	12	26	151	....	179	390	529,180
Chicago & Eastern Illinois	....	....	....	3	....	66	....	24	93	124,400
C. & N. W.—C. St. P. M. & O.	....	....	8	40	17	194	8	188	455	584,170
Chicago, Burlington & Quincy	....	....	22	58	....	163	74	173	490	672,800
Chicago Great Western	....	....	....	9	....	84	....	41	134	180,235
Chicago, Indianapolis & Louisville	....	....	....	....	....	47	....	10	57	79,700
Chicago, Milwaukee, St. P. & Pac.	....	....	....	35	22	173	52	208	490	636,460
Chicago, Rock Island & Pacific	....	....	7	31	35	139	48	153	413	517,560
Clinchfield	....	....	....	....	....	38	....	6	44	64,200
Colorado & Southern	....	....	....	2	....	12	....	5	19	27,200
Colorado & Wyoming	....	....	....	....	....	4	....	3	7	9,000
Columbus & Greenville	....	....	....	....	....	6	....	2	8	10,132
Delaware & Hudson	....	....	....	....	....	53	....	50	103	12,9500
Delaware, Lackawanna & Western	....	....	10	....	....	71	20	61	162	202,840
Denver & Rio Grande Western	....	....	....	6	5	79	48	37	175	234,760
Detroit & Mackinac	....	....	....	....	....	6	....	1	7	9,660
Detroit & Toledo Shore Line	....	....	....	....	....	4	....	4	8	10,880
Detroit, Toledo & Ironton	....	....	....	....	....	5	....	14	19	21,700
Duluth, So. Shore & Atlantic	....	....	....	4	....	9	....	8	21	29,500

* Number of Units Based on A. A. R. Statistics. † Horsepower Compiled by the Simmons-Boardman Publishing Corporation.

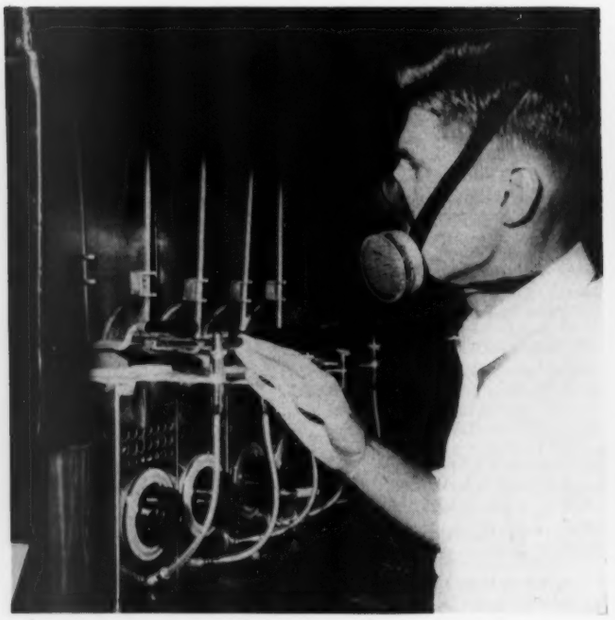
DIESEL-ELECTRIC LOCOMOTIVE UNITS IN SERVICE ON CLASS I RAILROADS—CONTINUED

Railroad	Number of Units in Various Horsepower Classes								Total	
	3000	2400 or 2500	2250	1800 or 2000	1600	1500	1350	1200 or less	Units	Horsepower
Elgin, Joliet & Eastern	....	....	....	36	....	14	....	111	161	187,900
Erie	....	....	16	12	58	165	24	129	404	552,780
Florida East Coast	....	....	....	26	....	23	....	....	49	86,500
Ft. Worth & Denver	....	....	2	2	....	12	....	5	21	31,100
Georgia & Florida	....	....	....	....	....	6	....	3	9	10,800
Georgia	....	....	....	....	....	13	....	10	23	29,900
Grand Trunk Western	....	....	....	....	....	22	....	36	58	67,700
Great Northern	....	....	....	13	....	239	96	118	466	631,500
Green Bay & Western	....	....	....	....	....	11	....	4	15	19,420
Gulf Coast Lines	....	....	....	2	....	52	....	19	73	99,650
Gulf, Mobile & Ohio	....	....	....	17	8	153	....	68	246	344,540
Illinois Central	....	....	8	22	....	2	4	137	173	214,980
Illinois Terminal	....	....	....	....	....	....	....	19	19	19,000
International-Great Northern	....	....	2	4	....	43	....	11	60	85,260
Kansas City Southern	....	....	....	11	....	47	....	35	93	129,160
Lake Superior & Ishpeming	....	....	....	....	2	3	....	1	6	8,700
Lehigh & Hudson River	....	....	....	....	13	....	....	....	13	20,800
Lehigh & New England	....	....	....	....	....	26	....	7	33	45,440
Lehigh Valley	....	....	....	14	10	66	8	126	224	271,260
Long Island	....	4	....	8	8	1	....	45	66	77,440
Louisiana & Arkansas	....	....	....	3	....	39	....	22	64	88,500
Louisville & Nashville	....	....	4	28	10	136	....	137	315	409,220
Maine Central	....	....	....	7	....	25	....	27	59	71,560
Midland Valley-K. O. & G.-O. C.-A.-A.	....	....	....	....	....	6	....	1	7	10,000
Minneapolis & St. Louis	....	....	....	....	....	16	9	46	71	78,950
Minneapolis, St. P. & S. Ste. Marie	....	....	....	....	....	96	....	18	114	160,980
Missouri-Illinois	....	....	....	....	....	1	....	3	4	5,700
Missouri-Kansas-Texas	....	....	19	6	29	91	....	28	173	265,650
Missouri Pacific	....	....	12	22	33	177	24	143	411	568,800
Nashville, Chatt. & St. Louis	....	....	....	....	....	86	....	43	129	170,420
New York Central System	....	....	18	103	213	343	10	550	1,237	1,548,160
New York, Chicago & St. Louis	....	....	....	11	....	13	....	93	117	135,140
New York, New Haven & Hartford	....	2	....	87	45	62	....	159	355	459,420
New York, Ontario & Western	....	....	....	....	....	7	18	22	47	56,180
New York, Susquehanna & Western	....	....	....	....	....	....	....	22	22	20,380
Norfolk Southern	....	....	....	....	5	10	....	8	23	28,780
Northern Pacific	....	....	....	....	....	135	44	68	247	328,740
Northwestern Pacific	....	....	....	....	2	13	....	9	24	27,460
Pennsylvania	22	36	28	213	169	376	....	701	1,545	2,072,790
Pennsylvania-Reading Seashore Lines	....	....	....	....	....	6	....	1	7	9,800
Pittsburgh & Lake Erie	....	....	....	4	....	10	....	47	61	72,000
Pittsburgh & West Virginia	....	....	....	10	1	....	....	1	12	22,600
Reading	....	....	....	....	50	54	20	117	241	292,560
Richmond, Fredericksburg & Potomac	....	....	10	....	....	25	....	22	57	82,000
Rutland	....	....	....	....	5	....	....	7	12	14,600
St. Louis-San Francisco	....	....	17	6	....	242	....	103	368	512,150
St. Louis Southwestern	....	....	....	3	8	33	20	36	100	132,100
Sacramento Northern	....	....	....	....	....	....	....	6	6	2,280
Seaboard Air Line	14	....	6	54	72	144	44	65	399	618,020
Southern Pacific (Pacific)	....	....	1	42	7	526	....	199	775	1,071,630
Southern System	....	....	7	35	32	399	70	176	719	1,001,950
Spokane International	....	....	....	....	....	....	....	9	9	9,000
Spokane, Portland & Seattle	....	....	....	1	2	44	....	28	75	99,120
Staten Island Rapid Transit	....	....	....	....	....	....	....	8	8	6,800
Tennessee Central	....	....	....	....	4	6	....	5	15	19,720
Texas & New Orleans	....	....	....	12	....	100	....	77	189	250,260
Texas & Pacific	....	....	8	10	....	134	....	32	184	273,400
Texas Mexican	....	....	....	....	....	5	....	13	18	16,820
Toledo, Peoria & Western	....	....	....	....	....	10	....	3	13	18,000
Union (Pittsburgh)	....	....	....	....	3	24	....	107	134	136,950
Union Pacific	....	....	....	65	....	329	....	207	601	837,080
Wabash	....	....	12	8	....	130	....	84	234	315,620
Western Maryland	....	....	....	....	8	35	....	24	67	86,360
Western Pacific	....	....	....	....	....	63	48	30	141	185,380
Total	36	††42	255	**1,310	965	7,469	1,173	6,360	17,610	23,561,137

**Includes 33 1800 horsepower units. ††Includes 22 2500 horsepower units.

Note: Since the number of diesel-electric locomotive units in the above tabulation were based on A. A. R. statistics, only those units, received by the railroads from the builders, that were reported to the A. A. R. as installed in 1951, were included.

A laboratory number is assigned to each incoming sample of lubricating oil.



Another indicator of dilution is the flash-point test.

Laboratory Control of Diesel Maintenance

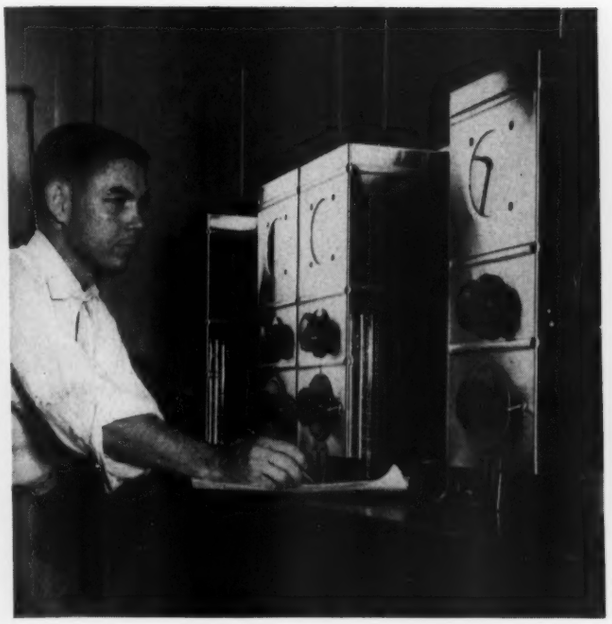
Two tests are made for insoluble matter, one to determine the amount of dirt present; the second to learn the presence of sludge, gum, varnish and other oxidized materials.

Diesel maintenance cost reduced substantially by lube oil testing program and other test department measures

A PROGRAM of periodic lubricating oil sample checking by the Southern's test department, one of several functions performed by the laboratory to keep diesel locomotive operating and maintenance costs to a minimum, locates many engine troubles before they become serious enough to require costly repairs.

Lube oil samples are taken after each 5,000 miles in freight service, each 10,000 miles in passenger service, at each monthly inspection for switching locomotives, and whenever the oil is changed for any reason. The average cost is $5.45 per sample in each of the foregoing instances; spectrographic analyses run on the same schedule are done at the Industrial Research Institute of the University of Chattanooga at a cost of $7.50 each.

During an initial 13-month period using the spectrographic analysis in addition to the regular lube oil tests, on 30 locomotives for the first three months and 50 thereafter, three crankshafts and one gear train were definitely saved by the spectrograph. The spectrograph was responsible for locating failures of such small parts as wrist pin bushings, which, while not expensive in themselves, could



Other diesel test work includes stack-gas analyses, investigation of cleaning compounds, and the oil distillation test (left). Running a viscosity test on a lube-oil sample to check for dilution and oxidation (right).

or a large number of red squares are found at frequent intervals for the locomotive, an investigation is begun immediately.

A Typical Case History

The value of the two types of lube oil tests is well-illustrated by the case history of a 1,500-hp. diesel A-unit having a 12:65 gear ratio. It was bought in December 1944 and used in mountain freight service:

Jan. 1945—First lube oil sample taken.

June 1946—Sample showed oil oxidizing, which would cause corrosion, due to acidity, and thickening, which would deposit gum on moving parts. Oil ordered changed. Engine examined, and oil cooler core found plugged. This was corrected, the oil and the filter changed.

Sept. 1946—Oil badly diluted. Master mechanic was wired to change oil and look for fuel leakage. Leaky injector found.

Aug. 1947—Dirt in oil. Oil and body filters changed ahead of time and filter system checked and cleaned.

May 1948—Oil again dirty, above procedure repeated. Water also found in the oil, caused by a leak around core of oil cooler.

June 1948—Oil again dirty, usual procedure repeated.

Sept. 1948—Oil diluted, caused by the P-pipes to two injectors leaking.

Dec. 1948—Water in the oil. Master mechanic wired to change the oil, inspect main bearings and look for leaks. Bearings o.k., but liner seals leaked.

Feb. 1949—Oil badly diluted, caused by a hole in the crown of the piston.

Feb. 1949—This unit was selected as one of 50 test locomotives for monthly spectographic analysis to determine presence of any residual metals in lube oil ash.

July 1949—The sample test showed oil to be satisfactory, but the spectrographic analysis indicated high residual metallic content of tin, copper, lead and iron. Locomotive ordered removed from service immediately by telephone for inspection. The bearings had wiped and the crankshaft was riding on the backs of the bearings and was on the verge of seizing. Engine overhauled and returned to service. Crankshaft failure prevented.

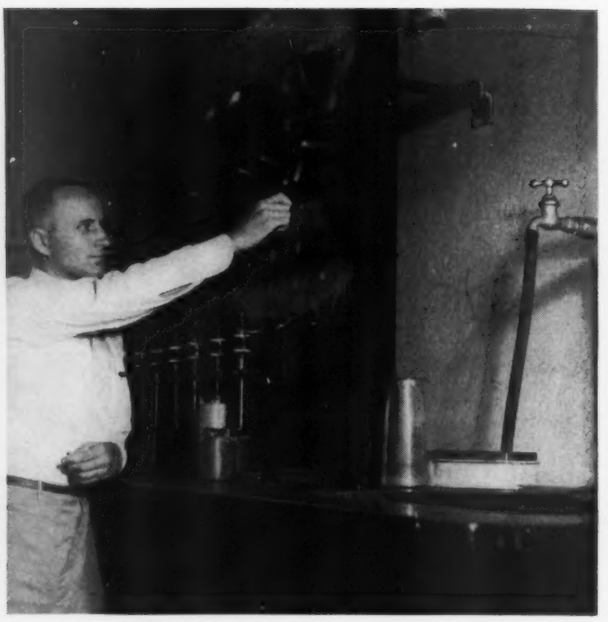
SPECTROGRAPHIC ANALYSIS RESULTS ON A DIESEL UNIT FOR 4 MONTHS SHOWING THE BUILD-UP OF METALS CONTENTS IN THE ASH IN PARTS PER MILLION FOR THE MONTH OF JULY WHEN THE RESULTS PREVENTED A CRANKSHAFT FAILURE

	June	July	Sept.	Oct.
Mileage	1,552	11,292	2,844	8,624
Gallons added	0	45	.....	.....
Ash	.25	.28	.30	.....
Fe	72.00	1310.00	105.00	238.00
Cu	8.00	50.00	10.30	16.20
Pb	2.45	10.10	2.30	14.00
Sn	.55	15.00	.70	1.75
Ag	.45	1.50	.55	.85
Al	.60	3.82	.....	.....
Ca	225.00	445.00	140.00	198.00
Ba	.....	.....	400.00	64.50
Sr	.....	.....	.....	47.50
Na	.....	.....	.....	Present
P	235.00	.....	183.50	178.50
Zn	.....	2.00	.....	.....
Mn	.65	3.60	.85	3.10
Ni	.26	2.15	.....	.....
Mg	.40	2.80	.10	.45
Cr	.....	4.30	.....	.....
Mo	.....	.....	.....	Present
Si	.....	.....	.....	.....

Another important diesel maintenance function performed by the test department is the investigation of cleaning materials and the development of cleaning methods for diesel power. Seven principal projects are currently being investigated and put into practice in the major divisions of diesel cleaning.

Ten different detergent cleaners were evaluated for cleaning parts and assemblies in hot baths to remove oil, varnish and carbon deposits. The result of this development was the standardization on a cleaner which sold for a much lower price than the one formerly used and did a better job.

A cleaner chemist visits all shops, prepares standard methods adopted to that shop's requirements, and in-



Left: Testing a lube-oil sample for acidity. Right: Miscellaneous work includes analyzing the composition of metals, such as the determination of the copper content of the brass sample above.

cause serious contingent damage, in this case a wrecked cylinder or worse.

Perhaps the best proof of the potential value of the spectrograph lies in a crankshaft which did fail. On this occasion the analysis showed a dangerous buildup of metal content in the oil, but due to a 25-day delay in obtaining the results during the initial test period in the use of the spectrograph, the crankshaft failed before the results of the analysis were known.

The periodic samples taken from all diesel locomotives are tested for four principal things: viscosity, flash point, and two types of insoluble matter. The test for the first type of insoluble matter shows the amount of dirt present in the sample; the second detects the presence of sludge, gum, varnish and other oxidized materials.

An average of three or four analyses out of each 24 show some trouble in the oil, and consequently in the engine. The analyses also indicate by the viscosity and viscosity index tests whether different brands of oil have been mixed by mistake.

Examples of engine troubles indicated by the oil tests are leaky seals, shown by water in the oil; inoperative by-pass valves, shown by dirt in the oil and found by a high precipitation number; leaky injectors, causing fuel oil dilution and shown by a reduction in viscosity; and exhausted additive, which results in an increase in oxidation.

Detail work in taking the sample is reduced to a minimum. The only equipment required is a standard one-quart screw-top can and a single form, TD-9. The top half of this form has 14 blanks to be filled in at the service point where the sample is taken, giving such information as the sample serial number, the locomotive number, brand and S.A.E. number of the oil, date the sample was taken, date previous oil change, mileage or hours and make-up oil added since previous oil change, whether oil or oil filters were changed when sample was taken and reason for change, types of filters and mileage since last change, any comments, and the person submitting the sample.

The lower half of the form is divided into two parts by a vertical line down the center. The right half contains instructions for taking the sample while the left half is reserved for the chemist to fill in information on the technical properties of the oil, such as flash point, viscosity, neutralization number, water, etc.

The service point fills out TD-9 and sends it to Alexandria, Va., if on the eastern lines, or to Chattanooga, Tenn., if on the central or western lines. The service point fills in the top half of the sheet. The test department then fills in the lower left portion of TD-9, and later transcribes this data to a second form, TD-10. Copies of this form are sent to the master mechanic, the general diesel supervisor, the superintendent of motive power, the diesel superintendent, representatives of the oil company, and the locomotive manufacturer's regional service representative. One copy is kept on file at the laboratory.

If the locomotive is transferred from one region to another, the records are also transferred with the locomotive from one laboratory to the other. If the locomotive is serviced at two or more points, or if the master mechanic and the general foreman of the service point are at different locations, both receive a copy of TD-10.

If difficulty is found with the oil, the master mechanic is required to furnish a report to the diesel superintendent, with copies to the oil laboratory and to the superintendent of motive power, advising what was found and how the difficulty was corrected. Where anything is found wrong with the oil, the master mechanic is notified immediately by telephone or telegraph. An entry of such a call or wire is made on TD-10. For example, if water is found in the oil, the master mechanic is immediately telephoned or telegraphed to change the oil and search for water leaks.

The diesel superintendent has a board of all locomotives. Check marks are entered after a locomotive when an oil sample is sent in. The square is colored red when something is found wrong with the oil. If three such red-colored squares appear in a row for any one locomotive structs personnel. He determines the contents of each cleaning tank, the proper cleaning charge to be added, the

amount of make-up cleaning material to be added each day, the life of the cleaning material before draining and the frequency and amount of recharging. All this information is stencilled on the cleaning tank. At the present time two principal types of hot bath cleaning are employed, one for steel, cast iron, brass and galvanized parts, the second for aluminum parts.

For cleaning interior painted surfaces on the engine and the locomotive cab, eight materials were tested. The test department standardized on one and developed proper equipment and methods for cleaning, such as where to use brushes, where sponges, etc.

Two ways were developed for cleaning and oiling car body filters, hot vats and automatic cleaning machines. Four materials were tested and one standardized on. The test department is currently working on the development of an improved type of oil for dipping.

For cleaning diesel locomotive exteriors six types of materials were investigated; methods, concentration and equipment to use were developed for each.

For cleaning the locomotive running gear, it was learned that an alkali cleaner was required to remove the combination of oil and dirt which had to be emulsified, while an acid-type cleaner was required to dissolve the deposit of rust from the brake shoes and red clay. The department developed a system of spraying with acid-type cleaner and washing off with an alkaline type. The spraying nozzles used for this work were also developed by the test department.

To clean and spray top decks and air box passages, three types of solvents were experimented with. Spraying equipment was developed which not only does a better cleaning job but reduces the fire hazard and the toxicity to the operator.

Materials and methods for cleaning electrical equipment are currently under investigation.

By means of the above technique expenditures for cleaning have remained about constant despite annual increases in the use of diesel power.

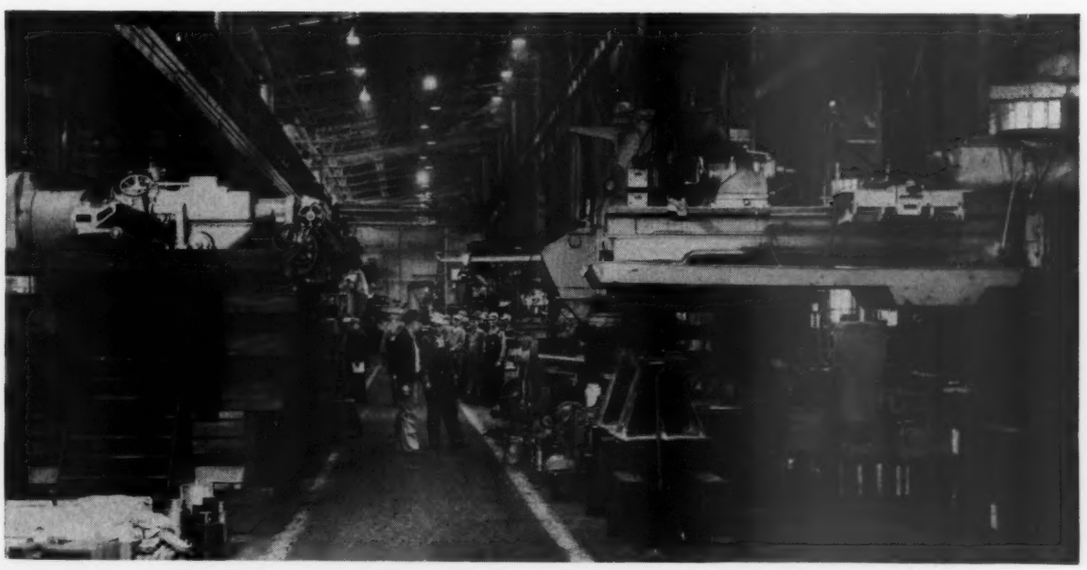
Various types of corrosion inhibitors were also tested, and an alkaline-sodium-chromate treatment standardized upon. The concentration is controlled by calibrated conductivity meters installed in each shop, serviced and maintained by the system water chemist. Water on the locomotives is tested each time the locomotive is in the house; the conductivity meters are tested every six months.

Despite the fact that large quantities of the inhibitor is used, the product is purchased in 20-oz. packages, which is the amount required for each 50 gallon of cooling water. While the cost per unit of the inhibitor is considerably increased by using 20-oz. packages rather than purchasing it in the bulk, it was felt that the use of small packages would be cheaper in the long run. Greater accuracy is attained, and waste is considerably reduced because people handling things that come in small packages tend to be more careful in avoiding spillage than with things which come in bulk.

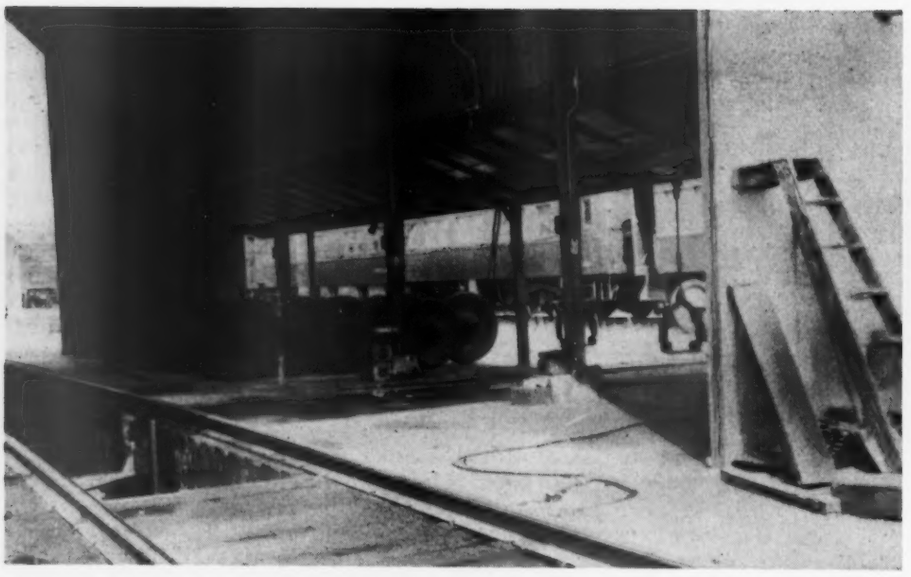
The test department also conducted extensive experiments with the use of anti-freeze on 25 switching and road switching locomotives which lay over 8 to 16 hours between working shifts. Two principal problems were encountered. One was the selection of an anti-freeze which had a sufficiently high boiling point, particularly for withstanding local overheating, without decomposing. A second was to prevent corrosion as the alkaline-sodium-chromate corrosion inhibitor was not compatable with the rust inhibitor in commercial anti-freezes. An ethylene-glycol-type anti-freeze was selected after assurance by the manufacturer that the organic corrosion inhibitor would be satisfactory.

Weekly samples were taken from each of the 25 test locomotives to test the effective corrosion inhibitor left by measuring the reserve alkalinity; to test for iron content in solution or suspension which would indicate corrosion of various parts; and to test the freezing point of the solution as a measure of weather leakage of the anti-freeze.

The cylinder liner assemblies in the engine crankcases were visually inspected monthly to see if any corrosion were occurring. All 25 locomotives went through an entire season without corrosion difficulties, indicating that diesel locomotives can be protected by anti-freeze.



This picture, taken April 21, 1952, in the Union Pacific's Omaha, Neb. machine shop, shows some of the preparations for the approach of flood waters. Past experience indicated that the elevation and removal of machine tools was a necessity in order to protect electrical equipment and other vital parts of the machines. Here several of the machine tools are raised to a point where they would not be affected by flood waters if they came. Fortunately, they did not.



The passenger-car-truck building. The drop pit is in the left foreground, the wheel storage area in the center background, and the box holders at the right.

Passenger Truck Work at Grand Rapids

SEVERAL interesting working arrangements and procedures have been incorporated into a building for handling Chesapeake & Ohio passenger car truck work on the Pere Marquette District at Grand Rapids, Mich.

The building is of corrugated steel 50 ft. long by 25 ft. wide enclosed along one side and both ends with the exception of the two entrance ways. The second side, which faces the coach yards, is open. A single through track extends along the enclosed wall with the center of the track 10 ft. from this wall, and the area between this track and the open side of the building is concreted. A winch is installed on the stub end of this track outside the shop for moving cars, and the building is well illuminated by overhead lights.

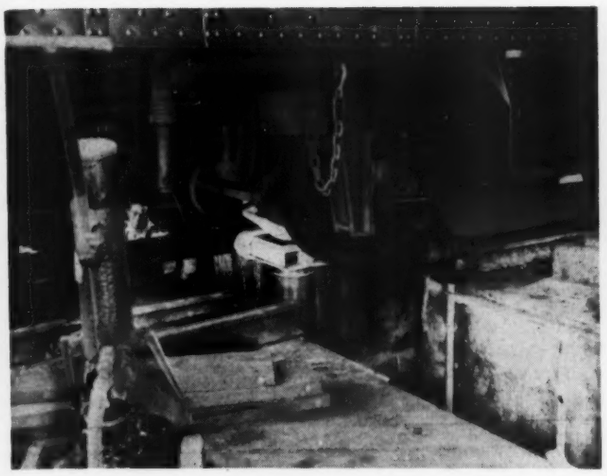
The center hoist on the near monorail handles the boxes between the floor and the two box holders which hang from the rear monorail. It also handles Hyatt and solid bearing boxes on and off the wheel set.

The through track has a drop pit located near the end of the building from which the general view in one of the illustrations was taken; this will be referred to as the working end of the building, as contrasted with the other, or wheel storage end. The pit is 22 ft. long and 3½ ft. deep, and it is equipped with a 30-ton electric jack for handling a single pair of wheels.

The outlet track for the drop pit is 18 ft. from the working end of the building and in the center of the 22-ft. pit. The outlet track pit is 12 ft. long. Standard gage rails are laid at floor level along the top of this pit beginning 6 ft. from the nearest rail of the through track and extending to the near track of the coach yard. This track is used for solid and roller bearing box changeout. It is convenient to the drop pit for wheels removed from cars on the through track, and to the storage area for mounted wheel sets immediately behind this track in the general view.

Two operations performed in the building are of particular interest because of the special equipment designed by the shop forces for performing them efficiently. First is the equipment for changing solid bearing and Hyatt roller bearing boxes. This comprises two monorails, one near the open side of the building, and the second 3 ft. inside of the first.

The first monorail is 12 ft. long, and from it is suspended two box holders mounted on rollers for travel



An old style car truck on the drop pit.

back and forth along the rail. The small vertical adjustments in height necessary to level the holders up with boxes mounted on different sized wheel sets are made by turnbuckles. These holders are not used to raise the box from the floor nor to lower it to the floor. They merely slip around the boxes and carry them at constant height clear of the journals of the wheel set.

Raising and lowering the boxes is done by a second box holder which hangs from the inside monorail. This holder operates on a tong principle and removes and replaces the box from the journal to the floor area when boxes are changed.

The second set of special equipment used in this building is for leveling new and old style cars and changing bolster springs on new style cars. It is used in the drop pit in conjunction with the 30-ton pit jack, and consists of fittings for this jack for the different operations.

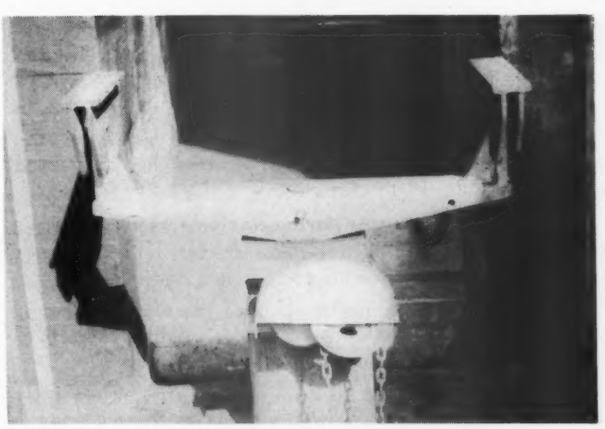
The jack crossbar is 41 in. long and therefore wide enough to fit around generator gear drives. It is 39 in. between the insides of the uprights, 5 in. wide, 4 in. deep at the center and 1½ in. deep at the ends. The uprights are 1 in. thick. The height from the crossbar to the top of the Y is 11 in., to the bottom of the notch of the Y is 9 in. The crossbar joins to the jack shaft through a 2½-in. pin.

The first set of fittings used with this jack are a pair of shoes to level or to adjust the height of old style cars by shimming under the spring plank. This is done by taking the weight off the coil springs after compressing the elliptic springs. The shoes for this job are made from sections of ½-in. plate welded together, have a length of 14 in. and a height of 8 in. The base is 3½ in. wide and has affixed to it a triangular section to mate with the vee of the Y.

For truck work on new style cars with all coil springs, a cradle is placed on top of the jack shoes. Two 50-ton air jacks raise the car body with the bolster. The cradle lowers and raises the spring arrangement for shimming or changing the bolster coil springs.

The cradle is 51 in. by 12 in. by 3 in. with an offset of 1 in. on each end as shown in one of the illustrations. It is built up from three lengths of 3 in. by 3 in. wood and four lengths of strap iron ⅝ in. by 3 in. all bolted together. The strap iron sections fit between the wooden sections and on each end. A 2⅜-in. hole is bored through the center wood to accommodate the center pin. The end blocks are 15 in. long, 3 in. high and 4 in. wide, and are on 46-in. centers.

The drop pit jack is fitted with a crossbar wide enough to fit around generator gear drive units.



The shoes in place on the jack for leveling or adjusting the height of old style trucks.

The cradle fits on top of the shoes for shimming or changing bolster coil springs.

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives*

Lubricating Oil Cooler

471-Q.—What does each unit consist of- A.—Each unit consists of a bundle of tubes rolled into tube sheets, which in turn are welded to the shell.

472-Q.—Can the tube bundle be removed from the shell? A.—No.

473-Q.—What kind of material is used in the construction of the cooler? A.—The tubes are constructed of seamless Admiralty metal, the shell and tube sheets of steel, and the end covers of cast aluminum.

474-Q.—How does the cooling water flow through the cooler? A.—Cooling water from the radiators flows into the top end cover of the unit, down through the tubes and out at the bottom.

475-Q.—How does the oil flow through the cooler? A.—The hot lubricating oil enters at the bottom of the shell, circulates back and forth across the tubes and leaves the cooler at the top.

476-Q.—What happens during this process? A.—Heat is removed from the oil due to its contact with the tubes through which the cooler water is flowing.

477-Q.—What provision is made to channel the flow of oil in the most efficient manner? A. — Baffles are provided inside the shell for this purpose.

478-Q.—What should be done after the system is filled with oil? A.—The shell, which contains the oil, should be vented to release any air that may have been trapped therein.

479-Q.—How can the shell be vented? A.—By removing the pipe plug provided in the top shell flange. After replacing the plug the unit is ready for operation.

Cleaning Cooler Tubes

480-Q.—When cleaning inside tubes (water side), how can access be obtained? A.—Access to the water side of the tubes can be obtained by unbolting the end flanges and removing the end covers.

481-Q.—How is the scale removed? A. — Soft scale may be removed by means of brushes. Should hard scale be present, tube cleaners may be used. Observe care in handling tubes as they are of a very thin wall.

482-Q.—How is the outside or oil side of the tubes cleaned? A.—The oil side of the tubes may be cleaned by steaming out or by circulating a cleaning fluid through the pipe connections provided at each end of the shell.

483-Q.—Before cleaning is started, what must be done? A.—It is necessary to drain the oil from the pipe tap in the bottom shell flange, and to blank off oil inlet and outlet lines.

484-Q.—How often should the oil side of the cooler tubes be cleaned? A.—Experience indicates that the oil side of the tubes should be cleaned yearly.

485-Q.—Is it necessary to remove the cooler from the locomotive for cleaning? A. — Cleaning can be done quickly without removing the cooler from locomotive by using 100 gallons of cleaning solution, heated and passed by steam through the oil side.

486-Q.—What should be the first operation? A.—Isolate the oil side by blanking off the inlet and discharge flanges and connect a steam aspirator for cleaning. Steam hose lines should be sufficiently long for cleaning the coolers in place. A Turco Steam unit or any similar aspirator unit is satisfactory.

487-Q.—How is the cleaning solution prepared? A.—By mixing 100 gallons of water with 4 lbs. of Turco "Steam Off" or 8 lbs. of Oakite "92."

488-Q.—What should be done to protect the engine cooling system? A.—Drain the engine cooling system as steam pockets will form during the cleaning process.

489-Q.—What other precautions must be taken? A. — During the operation avoid contact with the steam lines and fittings extending into the locomotive due to their high temperature.

490-Q.—What should be done further? A. — Fill the cooler with cleaning solution by closing the discharge valve from the cooler, opening the vent valve and opening the steam supply valve gradually.

491-Q.—What is necessary in order to clean the full length of the tubes? A.—It is necessary to first fill the cooler with the solution and to keep the cooler full during the cleaning process.

492-Q.—What is done after the solution has passed through the cooler once? A. — It is then discharged as waste.

493-Q.—What pressure should be maintained in the cooler during the cleaning process? A.—Pressure in the cooler should be maintained as near 50 lbs. p.s.i. as possible and should not exceed 75 lbs.

494-Q.—What should the rate of flow be held to? A.—Two gallon per minute approximately, or about one hour to pass all the solution through, and the cooler kept full during the operation.

495-Q.—Why should the vent line be kept open? A. — Material flowing from the vent line shows the cooler to be full.

496-Q.—What must be done to get the proper quantity of solution to flow with the steam? A.—The valves on the aspirator must be so regulated.

497-Q.—After cleaning, what must be done? A.—After cleaning, flush cooler with water by filling solution tank and passing the water through the cooler with the steam aspirator. A faster flow may be used than with the solution.

* This series of questions and answers relate specifically to the Alco-G.E. Diesel electric locomotives.

498-Q.—After flushing, what is required? A. — Thoroughly drain after flushing, opening the ¼" pipe tap in the lower shell flange.

499-Q.—Should the cooler be dried? A. — Yes. Pass steam through the cooler to thoroughly dry it.

500-Q.—After the cooler is dry, what should be done? A.—Return all connections to original status, removing flange blanks and replacing drain and vent plugs.

501-Q.—What inspection should then be made? A.—Inspect tube surfaces to make sure they are clean. They will not necessarily be bright but should be free of deposits.

502-Q.—Will the cleaning operation just described suffice for excessively dirty coolers, due to oil of improper characteristics or too long a period between cleaning? A.—No. They should be removed for vat cleaning.

503-Q.—If lubricating oil should appear in the sight glass of the expansion tank, what is it a sign of? A. — A tube failure.

504-Q.—What are the indications if water shows up in the lubricating oil? A.—The same thing—a tube failure.

Schedule 24 RL

Air Brakes

Master Controller and 21-B-Magnets and Bracket

1334-Q.—What action should be taken if control pipe 11 to the master controller is broken?
A.—It must be repaired to have an electro-pneumatic brake.

1335-Q.—What else can be done?
A.—Move brake valve shifter lever to *AU* position and proceed with the automatic brake.

1336-Q.—What should be done if the straight air pipe 4 is broken?
A.—It must be repaired to have an electro-pneumatic brake. Otherwise move brake valve shifter lever to *AU* position and proceed with the use of the automatic brake.

1337-Q.—What should be done if auxiliary reservoir pipe 6 is broken?
A.—It must be repaired to have an electro-pneumatic brake.

1338-Q.—Is the automatic brake operative?
A.—To have an automatic brake, the auxiliary reservoir leak must be stopped.

1339-Q.—What other course can be taken?
A.—The automatic brake can be cut out by closing brake pipe branch cut-out cock and use the independent brake valve.

D-24 Control Valve

1340-Q.—If any of the following: Displacement reservoir pipe 3, auxiliary reservoir pipe 5, or emergency reservoir pipe 2 are broken, what must be done?
A.—In case of breakage of any of these pipes close the brake pipe branch pipe cut-out cock. The automatic locomotive brake is inoperative but the independent brake can be used.

1341-Q.—What must be done if main reservoir pipe 6 is broken?
A.—Stop the leak by a close tight bend in the pipe.

1342-Q.—What operation is thus affected?
A.—During an electro-pneumatic or independent application the independent application and release portion slide valve will be blown from its seat.

1343-Q.—What does it depend on as to how much pressure is required to blow the slide valve from its seat?
A.—This will vary, depending upon the tension of the slide valve spring.

1344-Q.—In the event that the independent application and release pipe 20 is broken, what should be done?
A.—No repairs need be made, proceed and carry independent brake valve in running position.

1345-Q.—In this case how does the independent brake valve function?
A.—The independent application is lost but the quick release is still available.

1346-Q.—What features are lost if the actuating pipe 13 is broken?
A.—The independent quick release and electro-pneumatic locomotive brake cut-out features are lost.

1347-Q.—Should the pipe be repaired in order to proceed?
A.—No repairs need be made, proceed but do not use *lock-down* position of the independent brake valve since this will cause a blow at broken *13* pipe.

1348-Q.—If straight air pipe 8 is broken and cannot be repaired, what feature is lost?
A.—The electro-pneumatic brake is lost on the locomotive if the break cannot be repaired.

1349-Q.—What must be done to render the electro-pneumatic brake operative on other units?
A.—The break must be repaired on the straight air pipe side.

1350-Q.—What precaution should be taken?
A.—Do not close the pipe on the *D-24* control valve side.

1351-Q.—What results if controlled emergency pipe 35 is broken?
A.—The controlled emergency feature is lost.

1352-Q.—What should be done?
A.—Proceed with the rotair valve in *PAAS* position.

1353-Q.—What action should be taken if control pipe 16 is broken?
A.—If the break is between the control valve and the relay valve, repairs must be made to have a locomotive brake.

1354-Q.—If the break occurs beyond the branch leading to the brake cylinder relay valve what can be done?
A.—Repair the leak with a short close bend on the control valve side.

1355-Q.—What function is then lost?
A.—The H-24 Relayair Valve cut-off valve function is then lost.

1356-Q.—What is meant by a close tight bend?
A.—A close tight bend refers to tubing which can be doubled over and hammered tight enough to prevent serious leakage.

1357-Q.—Suppose that the break occurs at a flange fitting?
A.—A well fitted hardwood plug may be driven into the fitting to prevent serious leakage.

1358-Q.—What other methods can be used to advantage?
A.—Blank gaskets or discs under flange fittings or in iron pipe unions are methods that can be used to advantage.

1359-Q.—What should be done to move the locomotive to a terminal in the event that the brake pipe branch pipe is closed?
A.—The auxiliary and emergency reservoirs should be drained and open to the atmosphere.

ELECTRICAL SECTION

Plastic Electrical Tapes In Railroad Service

The experience gained on three railroads during the past four years affords a basis for recommended methods of using this type

by Gale Billard
"Scotch" Brand Electrical Tape Division
Minnesota Mining and Manufacturing Co.

A NEW technique in electrical insulation that has been widely adopted in railroad maintenance in the past four years, has resulted in both longer-lived insulation and lower costs.

The method consists essentially of using a single insulation material where previously two or three materials were necessary. This was made possible by the introduction of plastic electrical tapes shortly after World War II. The economies result from three factors:—less insulating material is used; application is faster; and the insulation requires less frequent replacement.

In the Rock Island shops, for example, ten rolls of various kinds of tape were formerly used on the average car rewiring job. Using plastic electrical tape alone, however, this figure has been reduced to only three rolls—a saving in materials of 70 per cent.

On a typical car rewiring job there might be 700 splices to be wrapped. With a saving of even half a minute on each splice, the car would be out of the shop and back in operation six hours earlier. According to Sam Hughes, Rock Island car wiring foreman, the double-duty plastic electrical tape has cut application time in half.

By no means limited to car wiring, plastic electrical tape has met the need for tough, durable insulation in diesel wiring applications as well. On one occasion, a

Left:—No. 33 tape applied to the neck of compression type, two hole connector lug in the main electrical compartment of a 2,000-hp. Fairbanks Morse passenger diesel locomotive. Right:—Here a splice is wrapped with plastic tape on high voltage controls of a 2,000-hp. Rock Island diesel locomotive

Soldered lugs on positive and negative junction bus bars between the Enginator and storage batteries are insulated by a wrapping with No. 33 plastic tape. Lines to air-conditioning machinery are harnessed into compact main trunk line at left, competely encased in wraps of the same tape for protection from wear and tear

Above: A moisture-proof seal for traction motor tube ends is provided by two layers of half-lapped No. 33 tape at each end of tube

Below: Road-blasted charging receptacle cables are protected from abrasive effect of flying particles by heavy wrap of tape

Rock Island road diesel came in with the traction motor leads so badly burned that the insulation was charred, blistered and cracked. No replacement units were available and the diesel was needed for immediate use. The leads were stripped down and re-insulated, using "Scotch" No. 33 electrical tape, and the locomotive went out again.

Although it was expected that it would be necessary to replace the leads the next time the diesel was in the shop, the taped leads were still in service when the traction motors were shopped some quarter of a million miles later. The tough plastic had withstood the operating voltages, moisture and undercar blast of the 90-mile-an-hour diesel, and was still in good shape.

In this report, the author is concerning himself with the plastic electrical tapes with which he is most familiar, "Scotch" Electrical Tapes No. 33 and No. 22. and with the railroads that he knows best, the Chicago, Rock Island and Pacific; the Atchison, Topeka and Santa Fe; and the Illinois Central. The descriptions of the various maintenance uses of these tapes are taken from one or more of these railroads with their permission.

The two plastic tapes, No. 33 and No. 22, are essentially the same except in dimension. No. 33 is 7 mils thick and ¾-in. wide, while No. 22 is 10 mils thick and made in a variety of widths. Both tapes have a smooth, black, vinyl plastic backing, and both have a pressure-sensitive electrical grade adhesive which offers high "tack" for easy application.

The dielectric strength is 7,000 volts for No. 33, and 10,000 volts for No. 22,—approximately 1,000 volts per mil of thickness, measured by the A.S.T.M. short time tests. Insulation resistance is 200,000 megohms for both tapes, tested at 90 per cent relative humidity, 72 deg. F. Other properties common to both tapes are resistance to water, salt, acids, alkalies and oil; no aging at room temperature; unaffected by sunlight; will not corrode copper; will not support combustion; and will not loosen with age.

Railroad applications demand an unusual range of insulation properties. Not only must the electrical properties of the insulation meet high standards, but the material must be able to withstand mechanical abuse, have good thermal endurance, and high chemical and moisture resistance.

The plastic tape,—complete insulation and protection in itself,—meets these requirements in a single wrapping operation. The inner wrap of the tape provides the necessary electrical insulation; and the outer wrap protects against abrasion; and both the backing and the tight ad-

Splices and connections in crowded junction boxes of centralized train control system are compact and easy to pack in when insulated with 7-mil or 10-mil plastic tape

Control wires from Enginator, air-conditioning compressor and other undercar equipment are held and protected with a neat, trouble-free sheath of plastic tape

hesive bond between wraps provide the necessary barrier against oil and moisture.

In addition, the insulation should be easy to apply. Since the railroad electrician is often working in a limited space and often taping from an awkward position, the handiness of completing the job with a single roll of tape is an important factor.

Which of the two tapes to use is usually determined by personal preference and experience. The heavier No. 22 tape is used where maximum abrasion resistance is needed. The thinner No. 33 tape is used for most other applications, especially those requiring ultra-thinness in the finished insulation, as in junction boxes.

The several hundred different electrical maintenance jobs for which the tape has been used on railroad rolling stock can be divided into two broad classifications,—diesel locomotive applications and passenger car wiring.

In diesel applications, the plastic backing of the tape enables it to withstand the splash and spillage of lubricants without deterioration. When such tape is tightly wound and half-lapped, the oil cannot penetrate the layers and thus cannot affect the adhesive properties.

Another source of trouble is moisture. The warm air created by the diesel engine cools and condenses, causing moisture to form on the wiring system. This causes trouble in two ways:

(1) If the conducting moisture works in between the layers of insulation, it forms a path for current flow. With the tight-fitting, adhesive-sealed wrap that is obtained with the plastic tape, there is little possibility of this occurring. (2) The moisture, if absorbed by the insulation, causes changes in the electrical properties of the material, which may result in a breakdown.

The relatively low moisture absorption of the plastic tape,—approximately 0.3 per cent by weight after immersion,—minimizes possibility of this type failure. Many types of jointing materials formerly used absorbed 5.0 per cent to 7.0 per cent moisture,—16 to 23 times as much.

In actual diesel applications, both the main generator and the auxiliary generator leads or bus,—as well as the reversing field leads,—are insulated either with No. 33 or No. 22 tape. Several half-lapped layers applied here provide protection against electrical puncture.

Conformability of the tape allows it to be applied with a minimum of stretch,—an important factor since stretching lowers puncture strength. In addition, stretch causes mechanical stress, and the dielectric strength of a material can be greatly reduced under these conditions irrespective of thickness. Usually 10 per cent elongation is sufficient for corformability without producing undue stress.

Another widely used application is splicing and protecting the starting battery cables and lugs. The thin plastic tape, having high resistance to acids, is half-lapped once around the cable, thus preventing deterioration of the original insulant and providing longer life.

In repairing and splicing battery cables with No. 33 tape, two things are considered: (1) The design of the joint, which is determined by the type of connector used, and the amount of penciling of the cable insulant, etc. (2) The amount of insulation and protection needed. Railroad electricians consider both the electrical and mechanical conditions prevailing.

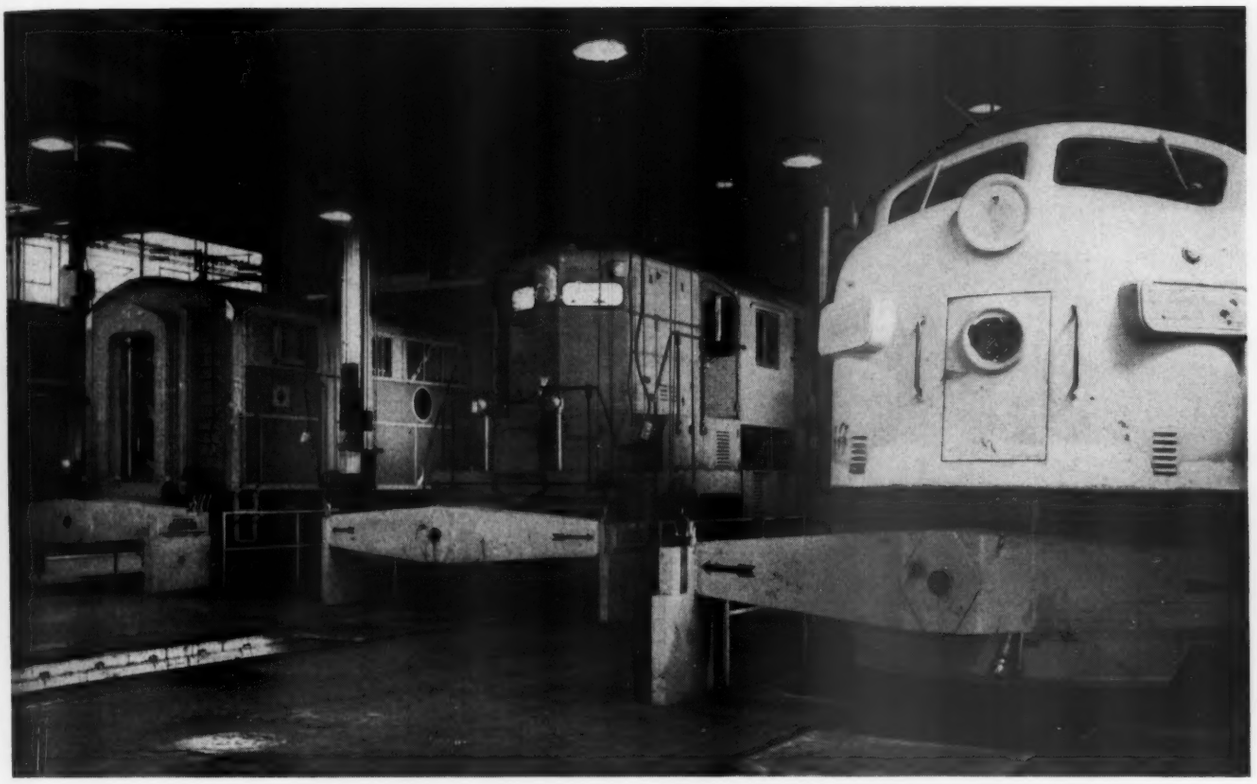
For example, a joint with no protruding sections, and no forces pressing it against the side of the enclosure, needs a minimum build-up,—usually two or three half-lapped layers. If the joint, however, has sections subject to contact with the box, or considerable abrasion, another layer or two is added. Heavy cable joints are blocked or racked if they show any tendency to rub on the enclosure.

Plastic electrical tape plays an important part in the high voltage control cabinet and in insulating the control wires. Insulation failure of a control wire is repaired by removing the old insulation and applying two half-lapped layers of No. 33 to the small wire. The tape is also used to improve the appearance of the terminal connector where it joins the wire. One turn of tape around the neck of the terminal does the job.

Control wires are taped into neat, compact harness-assemblies to insure trouble-free operation. The plastic envelope formed by the tape makes handling easier and protects the original wire insulation against oil, moisture, and deteriorating fumes.

When the moisture and dirt are present, surface leakage paths may form, causing damage to the insulation.

(*Continued on page 99*)

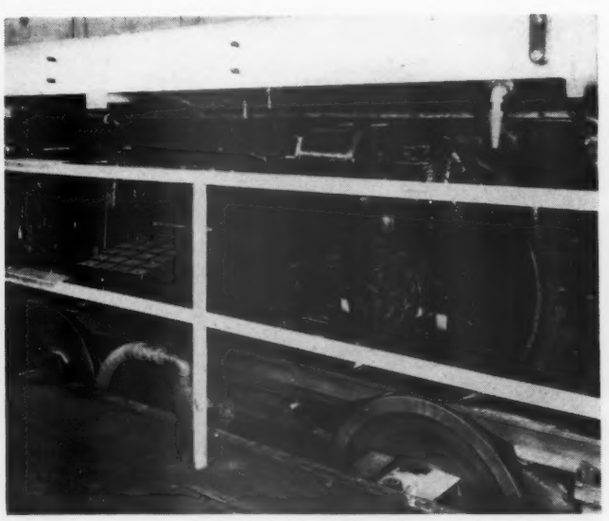


Three locomotives being tested on the three treadmills in the La Grange, Ill., plant of the Electro-Motive Division, General Motor Corporation

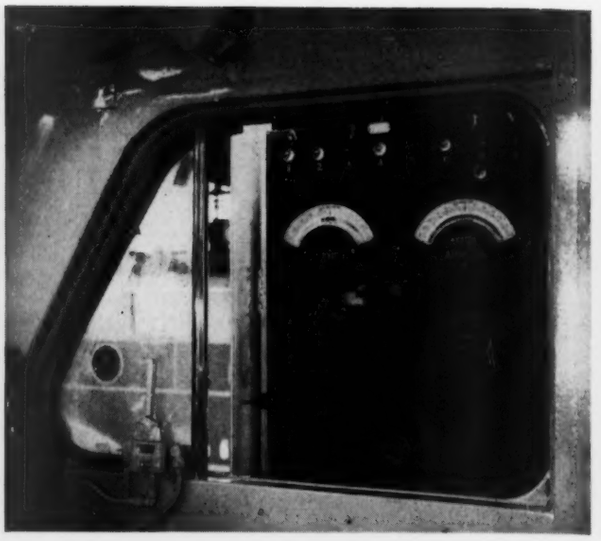
"Treadmills" Test Locomotives

Three dynamometers developed by Electro-Motive are used to load-test new and rebuilt diesel electric locomotives

A general view of one of the treadmills



How the wheels of a locomotive truck engage with those of the mill



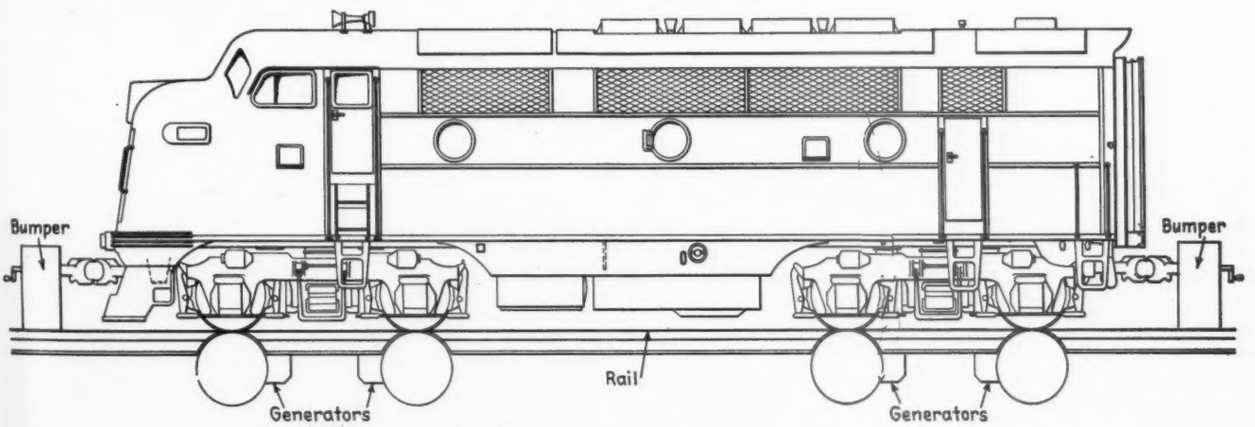
Above: A control stand panel as it appears through a locomotive cab side window. At left: A door height and a window height mill control stand. The bracket instrument at the left of the panel are mill speedometers. There is a hostler controller below the left panel. The two stands provide for different types of locomotives

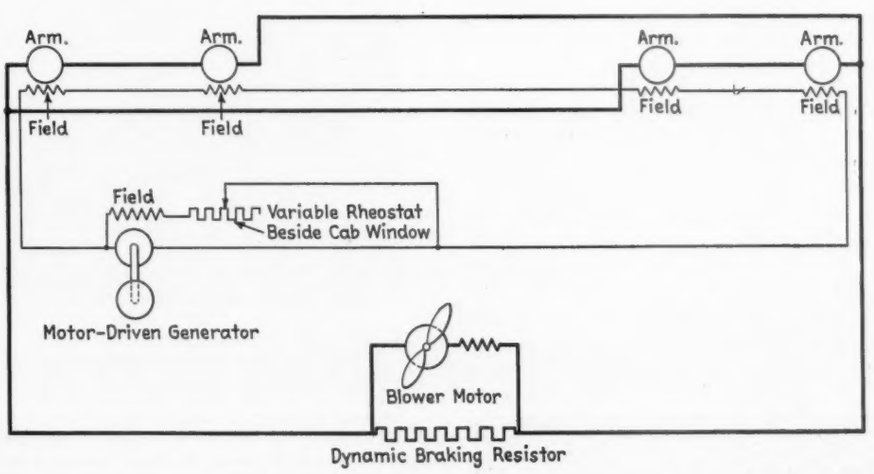
AFTER they are completely assembled and before they are painted, all new and rebuilt diesel-electric locomotive units coming out of the La Grange plant of the Electro-Motive Division, General Motors Corporation are given load tests. Three dynamometers, referred to in the plant as "mills" are used for this purpose. By this means, carefully controlled load tests are made without the need of a test track or road test with a dynamometer car.

The mills are, in effect, locomotive trucks turned upside down in a pit. The locomotive to be tested is placed on the mill wheels, which turn when the locomotive is operated. The motors of the mill trucks then operate as generators and are loaded on dynamic braking resistors. Excitation for the mill motors is supplied by a motor generator set.

Bumper blocks with a cross beam in place showing how the hoists are used to lift the beam when a locomotive is to be moved. The two blocks and the several notches in the blocks accommodate ocomotives of different lengths

Left: A treadmill with a single control stand. Right: Telescoping connections which may be moved vertically and longitudinally, connect the locomotive stacks with the exhaust hood in the locomotive building





Above is shown a locomotive as it stands on the wheels of the treadmill. Below is a schematic wiring diagram for the principal treadmill circuits

The wheels of the mill motors have no flanges and the upper edge of their rims are flush with the mill track as shown in the diagram. Sections are cut out of the track to make this possible. When a locomotive is to be tested, it is driven on to the mill track, and stopped when the wheels of the locomotive engage with those of the mill. Removable cross beams in the bumpers on each end are then lowered into place by hoists. The couplers of the locomotive are engaged with those on the bumpers and screw adjusters on the bumpers are then turned until the locomotive rests on the mill wheels without touching the track rails. This is done while the locomotive is operated in both directions.

During the test, the locomotive is operated under its own power, driving the mill generators. To control the load, the field of the mill generators is varied by means of a rheostat in the field of a motor-driven generator. This rheostat is placed outside the cab door or window of the locomotive being tested so that the operator may adjust the load while he operates the locomotive throttle. Any desired combination of speed and load may be obtained at speeds up to 50 m.p.h. Each mill has its own motor-generator set for excitation. Blowers driven from shop power are used to cool the generators.

On the load generator control stand outside the locomotive cab window, there are instruments showing generator armature volts and amperes, field volts and amperes, and two field rheostats respectively for coarse and fine adjustment of generator field strength. Below the panel on the outside control stand on two of the mills, there is a hostler controller. These are used to control engine operation on B units not equipped with hostler control.

There are speedometers on each of the mills. These are equipped with overspeed trips which will open the locomotive generator field in case excitation should be lost on the mill generators.

The three treadmills are essentially similar and differ only so they may accommodate different types of locomotives. The mill known as No. 1 will test F7, FP7 and E8 locomotives. Mill No. 2 will accommodate GP7 and F7 locomotives and No. 3 is designed for F7s. The No. 1 mill has eight generators and eight track openings to accommodate the different wheel bases of the types of locomotives tested. Unlike the other mills, it is equipped with selector switches which may be used to cut in the four generators being used, and cut out the other four.

Exhaust gases from the engines are carried out through the roof by means of stack adjusters which connect the locomotive stack to the exhaust hood. The hood may be lowered or raised and moved horizontally to accommodate different locomotives.

Test Procedure

The locomotive is first run in both directions with the throttle in the second notch while a check is made of the wheel slip relay functions. This is done by unbalancing the wheel slip circuit.

The second step in the test consists of checking the actions of the ground protective relay. This is done by applying an artificial ground successively to each side of the power circuit and watching the relay action. A visual check is also made of all rotating equipment, of oil pressure, water temperature and fuel supply.

After a warm-up, when the water temperature reaches 140 deg. C., a manual sequence check is made. This consists of going through all of the transitions forward and backward while the engine is operated in the second notch.

The throttle is then advanced to the fourth position and the engine is run for 20 minutes. The engine water temperature alarm switch is set and the cooling fan speed and the operation of the a.c. cooling fan contactors are checked. At the end of the 20-minute period, the unit is shut down and a general check is made of journal and motor bearing temperatures and motor temperatures.

The engine is then restarted and the unit is operated for ten minutes in the sixth position, at 10 m.p.h., for 10 minutes in the seventh position at 14 m.p.h., and then a full load run of two hours is made in the eighth position. This is done at 18 m.p.h. on the F7, and at different speeds on other units, depending upon the gear ratio. The direction of rotation of the motors is reversed every fifteen minutes.

During the run, all functions are checked and temperatures noted. Any leaks are noted and recorded for subsequent repair. Temperature controls and relay current settings and transition operation are checked. The a.c. generator voltage is adjusted near the end of the run after temperatures become stable.

Steam generators are operated during the tests and all functions checked.

During the process of manufacture and before being assembled in the locomotive, all generators, motors and engines are load tested.

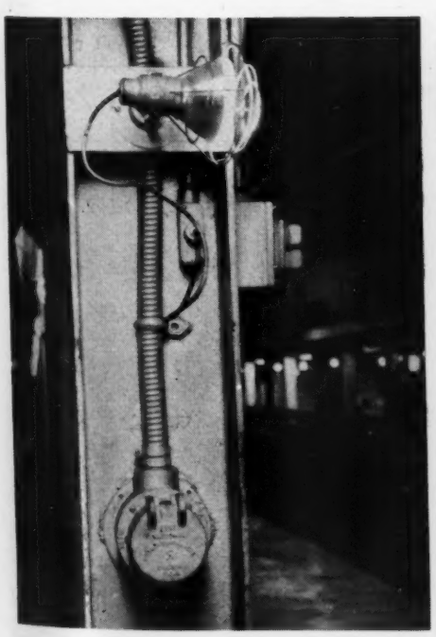
At the conclusion of a test, when it becomes necessary to run a locomotive off the mill, it is, of course, standing on wheels which will rotate, and thus prevent movement of the locomotive. This apparent difficulty is overcome by applying field to the mill generators to produce the necessary tractive force. On one mill, the position of the generators is adjustable, so that when a locomotive is run off the mill, the locomotive wheels must pass over an open gap in the rails. To make this possible, a heavy bar or rail is parallel, inside and a little below each rail. As the locomotive wheel passes over the gap, its weight is supported by the wheel flange running on this inside rail which spans the gap.

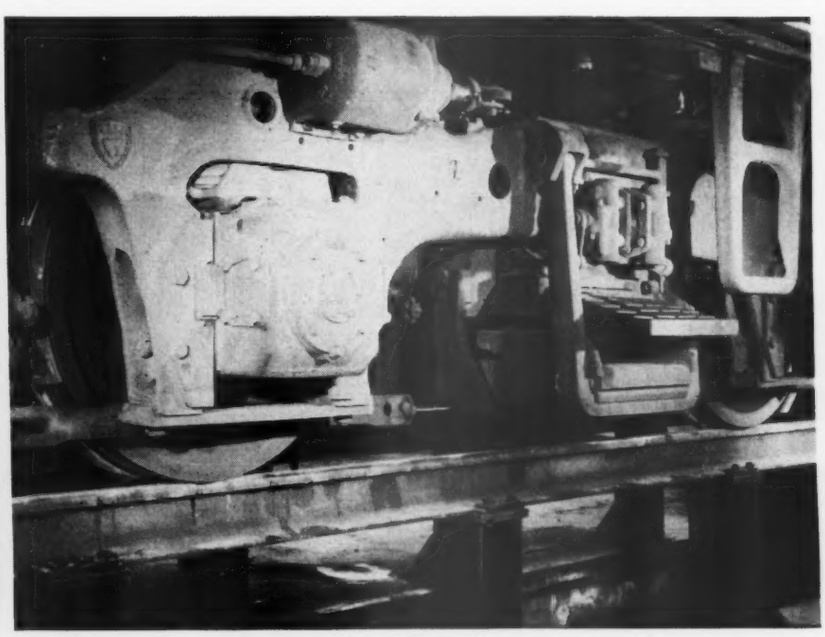
Another photograph, taken April 21, 1952, of flood preparation in the Union Pacific's Omaha, Nebraska Shops. Large machines were raised on blocks as shown and many car loads of equipment were shipped out of the shops to higher ground. During the high water, no dike or levee in the Omaha, Neb.—Council Bluffs, Iowa area failed. Elevation and removal of machinery proved to be good insurance. Household goods of 20,000 people were removed from homes in the Council Bluffs area. There were 31 miles of built-up dikes around Omaha and Council Bluffs

Night view of the shop. The overhead lighting is produced by pairs of 96-in. slimline fluorescent lamps in Westinghouse metal trough fixtures

Facilities for the Diesel Service Shop

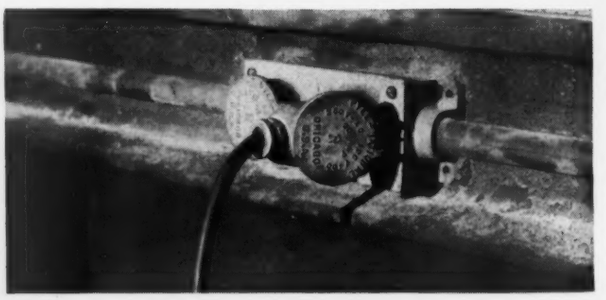
Atlantic Coast Line Shop at Florence, S. C., has adopted and developed many devices which facilitate the servicing of diesel-electric locomotives



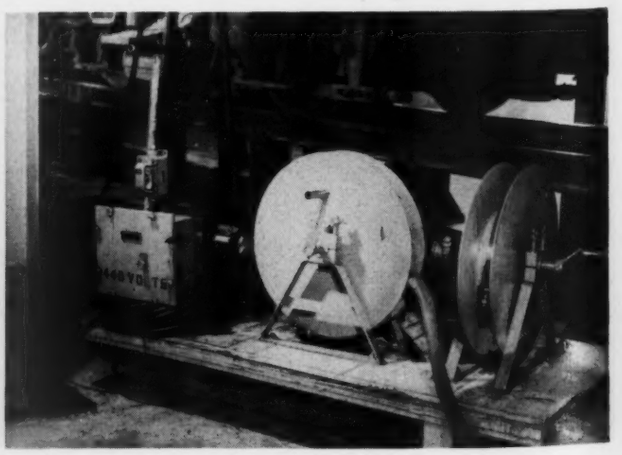


Above, left: On the side of every column, six feet above the floor, there is a 150-watt reflector flood lamp in a Sterber swivel socket with a wire lamp guard. The socket makes it possible to direct the beam of light from the lamp in any desired direction. The receptacle below the lamp is a 600-volt, 60-amp., Pyle-National Pylet used as a 220-volt, 3-phase power outlet for operating the locomotive ventilating fans when the engines are shut down. Above, right: An example of the kind of below-platform lighting produced by a two-lamp fluorescent unit and a reflector flood lamp at each end of the fluorescent unit

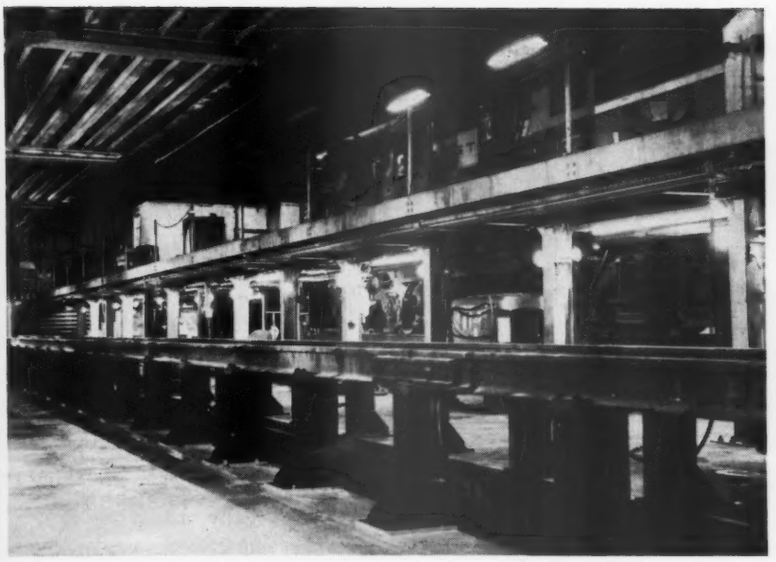
Above, left: Two Louis Shepard Totemaster engine-powered trucks, fitted with special flame-proof exhausts, do all the hauling of materials, and supplies. The piping, which may be seen on the ceiling, supplies water, compressed air, fresh lubricating oil and carries away waste lubricating oil. At the end of each air line, there is a vent used to remove moisture which may be trapped in the line. Above, right: The oil pumps which supply fresh lubricating oil may be started and stopped from any one of a number of pushbutton stations located like the one shown above the platform or from others mounted on the supporting columns under the platform



Above: Pyle-National, 250-volt, 30-amp., twin-outlet Pylets are mounted at intervals on the web of the elevated rails. They are on the inside of the rails over the pit and supply 115-volt power for portable extensions. At left: General lighting below the platforms is supplied by pairs of 96-in. fluorescent lamps in Westinghouse through-type fixtures mounted between every other pair of supporting columns



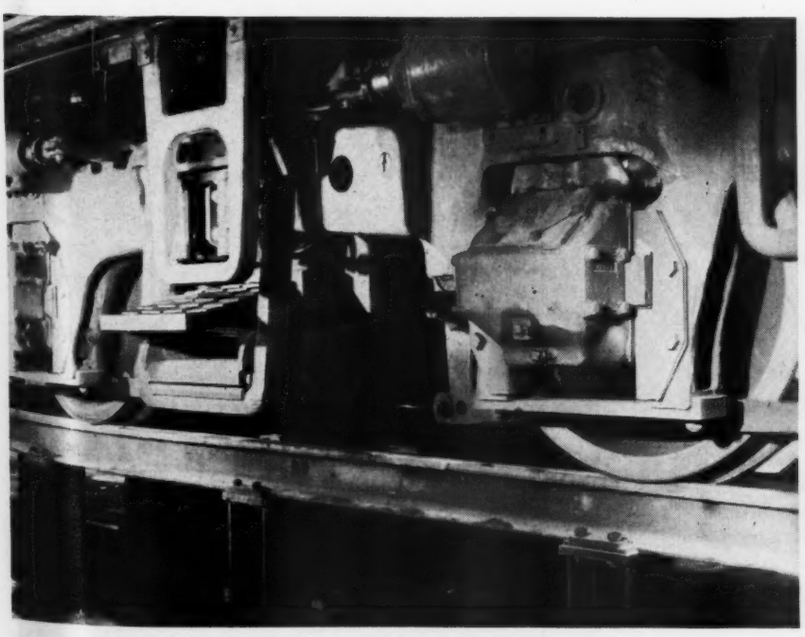
Above, left: The portable welding set, made by the Motor-Generator Corporation, Troy, Ohio, consists of a 440-volt, 3-phase, 1,750-r.p.m., a.c. motor, driving a 45/90-volt, 300/150-amp. welding generator. Above, right: Waste oil is removed from the locomotive and forced into the waste oil lines by a railroad designed assembly of equipment on a three-wheel, rubber-tired truck. The two hoses required, when not in use, are wound on two reels. The Blackmer pump is driven by a General Electric, 3-hp., 440-volt, 3-phase motor having an across the line starter with push-button control

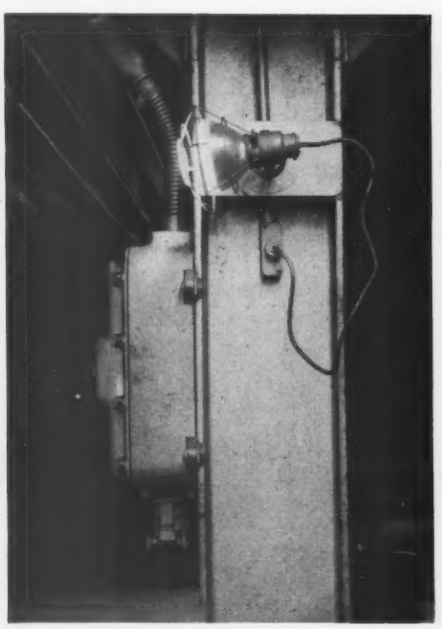


Above: One side of the shop showing a pit, elevated track and a deck level platform. At left: A piece of fire protection equipment assembled by the railroad which consists of a John Bean fire pump and a hose reel made by the Division Food Machinery and Chemical Corporation mounted on a truck. The pump is motor-driven by a 440-volt, 3-phase, a.c. motor and supplies water either as a jet or as mist at a pressure of 600 lb. per sq. in. The hose nozzle rests in a cradle and the act of lifting the nozzle closes a switch which automatically starts the pump

THE greater part of diesel-electric locomotive service shops follow a general pattern of elevated tracks, shallow pits between tracks, locomotive deck-level platforms, through tracks, etc. But the facility with which work is performed in the shop is dependent in considerable measure upon the methods and devices which are selected or developed to perform certain functions.

The equipment, largely electrical, shown in the accompanying pictures, constitutes a part of that which is used in the Atlantic Coast Line service shop at Florence, S. C.





Above, left: View of a locomotive truck in the under-platform lighting, looking toward the center of the unit; the other similar picture shows the truck looking toward the end of the unit. Above, right: One of the reflector lamps, in its swivel socket and at the left is a Pyle-National circuit breaker and receptacle which is an outlet for 440-volt, 3-phase power for the portable welding set and for a waste oil pump, both of which are shown in other pictures

DIESEL-ELECTRICS—How to Keep 'Em Rolling

10 Inspection and Tests

It's Quite Simple

The maintenance of electric machinery is really a mechanical job. This is true, not only for bearings and gears, but also for the electrical parts. Moreover, motors and generators are so much alike that their parts can be treated the same. Actually, the care of these parts is no more mysterious than that of bearings and gears.

Whatever occurs electrically leaves its mark in some mechanical change that tells the story. The commutator surface, for instance, is like an open book. It shows the general health of the machine more clearly than any other part. Here sparking, abusive overloads and flashovers all trace their record. So the commutator is the first place to look when you remove inspection covers.

Let's Take a Look

Like gears, commutators give warning of trouble in advance. They seldom fail suddenly. This gives time to locate the trouble and correct it. Neglect to do this may lead to gradual destruction of the commutator surface, breaking of brushes, flashovers and final complete failure.

The commutator surface is all important. When it has a smooth polish, either light or dark, it is reassuring. Even a regular pattern of light and dark bars is no cause for alarm as long as the bars are polished. This may only mean that the motor is operating close to its commutation limit. The pattern may come and go with service and operating conditions. Remember, temperature, weather, gases, brush grade and current flow all affect the thin film. And, it is this film that gives the copper surface its appearance. However, if you find a pattern of serious bar edge burning, look for trouble. Neither is all well when the surface shows irregularly spaced groups of dark, dull or burned bars. This means that the brushes are no longer riding the commutator. They are bouncing, jumping and sparking viciously enough to burn the surface. Such a condition seldom corrects itself. Instead it gets worse and worse. At first the bad spots are far apart and the surface between them still polished.

If a traction motor happens to stop with such a bad spot in full view, you are lucky. Then you can get a head start on the trouble. More likely, it will stop with the defect hidden. When you suspect motor trouble in

This is the tenth of a series of articles on maintenance of diesel-electric equipment. This article is written by J. W. Teker, Locomotive and Car Equipment Department, General Electric Company, Erie, Pa.

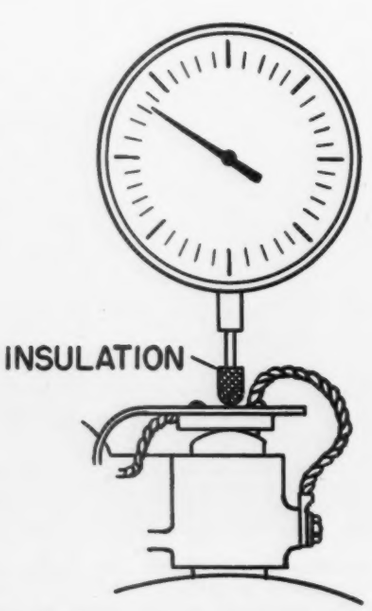


Fig. 1—How a dial indicator may be used to check commutator surface

Fig. 2—Burned commutator bars resulting from open circuit in armature winding

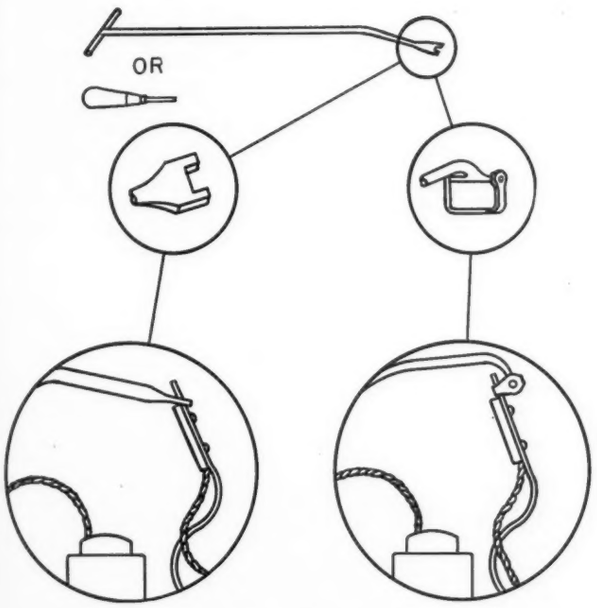


Fig. 3—Lifting tools and how they are used on traction-motor brush springs

service, it will be worthwhile to move the locomotive slowly while the man in the pit watches the commutator. If you are suspicious of a commutator, don't be satisfied with a one-sided look. The trouble may be playing hide-and-seek.

Generator commutators are easier to look at because covers can usually be removed on both sides. The part hidden under brushholders can be uncovered by "barring" the engine over a few notches.

There's More Than Looking

This is about all you can do by looking. To learn more you must feel, listen or measure. If the motor is out of the truck, if the wheels are jacked clear of the rails, or if a drop pit table is lowered, you can run the motor and feel or hear a rough commutator. A generator may be checked while the engine is idling.

A distinct click can be heard as each brush goes over a step in the commutator surface. Or the brushes will chatter as the rough spots disturb them. Hold a fiber or wood stick (for insulation) about the size of a long pencil lightly on the brush or on the spring right over it. This will give you the feel of the brush as it rides the commutator. The bad spots can be clearly felt as they go by. Check traction motors when turning in both directions. as there is sometimes a difference in the degree of roughness.

The most accurate way to check commutator surface is with a dial indicator (Fig. 1). Clamp it to the motor frame so that the indicator tip touches the spring directly over the brush. Be sure the brush is free to move in the holder. See that the spring pressure is strong enough to hold the brush against the commutator surface. Otherwise, it may hang against the indicator and fool you. Mark the starting position and turn the motor slowly but steadily. This is not always easy to do. The brushes may rock back or tilt and lose the zero dial setting. If the turning is opposite to the direction in which the motor was last run, the brushes may chatter as the bar edges go by. Fit the brush in, or reverse the direction to get a

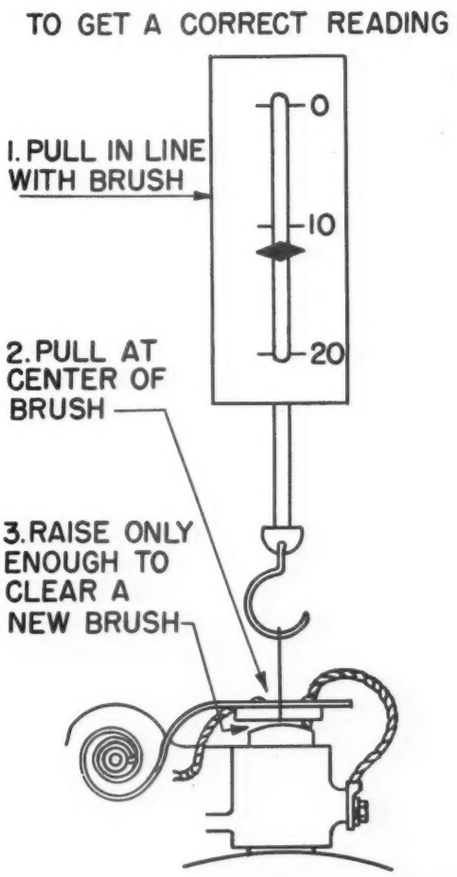


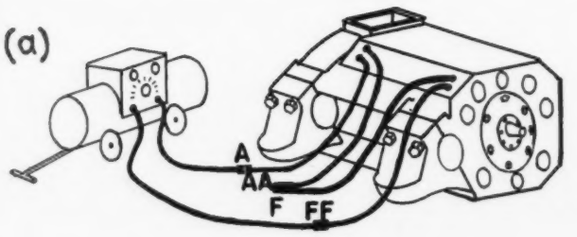
Fig. 4—How to measure brush-holder spring tension with a spring scale

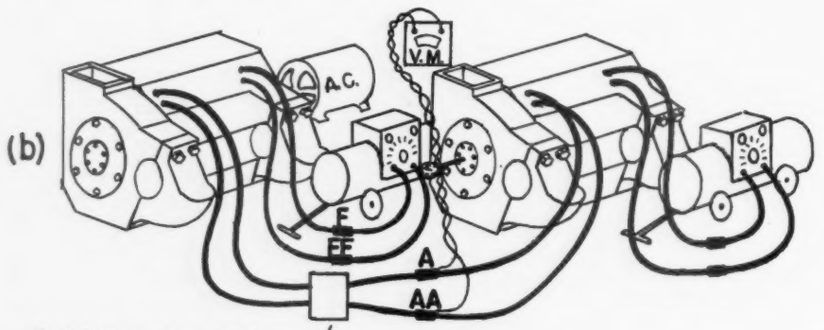
steady reading. A quick reading can be obtained by following the indicator as the locomotive is moved over the pit. If the machine is to be turned with voltage on it, the tip of the indicator should be insulated from the brush. Otherwise serious damage to the indicator will result from current passing through it to ground. A rubber or fiber tip will do the job. Even a good piece of scotch tape will serve if it is stuck on so it won't jar off. Watch the indicator for sudden swings. It is these quick dips in the surface that upset brush contact most. A brush may ride easy, gradual swings without losing contact. But, sudden swings of the same amount are hopeless, even with strong spring pressure. The faster a motor operates in service the truer this is. If you find a rough commutator on a motor due for changeout soon, you may wish to let it go unless it is already causing trouble.

Resurfacing Commutators

When chipped brushes or flashovers resulting from a rough commutator interrupt service, it's time for a resurfacing job. This may be done with the motor in place or removed from the locomotive. In either case, a few precautions should be taken. If the work is done with the motor in place, block the remaining locomotive wheels to prevent rolling off the jacks. Remove or raise the good brushes, or they will grind into carbon dust and mess up the insulation. Since the current to drive the motor is small, one brush each in a positive and negative holder will do. Clean up greasy muck on insulating surfaces so that carbon and copper dust will not stick. Now go ahead with the resurfacing job.

On generators, remove a brush holder and install the grinding tool first. Warm up the engine so it will start easily. Then raise all the brushes that are hard to reach. Crank the engine with a few brushes in holders of each polarity that are easy to reach. Wear gloves, goggles, and a respirator. Rake and blow conducting particles from between bars. When possible, air-cure the commutator up to full speed and voltage.





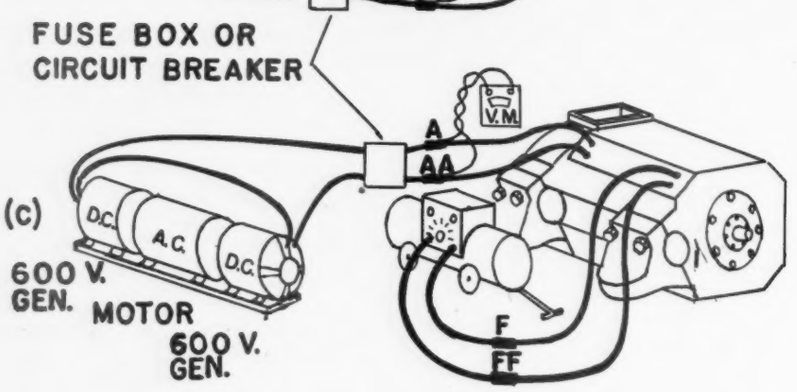


Fig. 5—Various means of supplying power for running tests on traction motors. (a) Above: welding set.

(b) Left. Another traction motor driven by an a.c. motor.

(c) Left: Two d.c. generators connected in series and driven by an a.c. motor

In resurfacing, watch how the last part of the surface cleans up. At times four equally spaced areas will show up on motor commutators. This may point to abusive stalling lasting long enough for the current to heat and raise the bars under the brushes. Scratch a mark on the ends or risers of the bars in this area. If the trouble repeats in the same place after the motor is back in service, you can suspect annealed bars caused by such local over-heating. Then the motor should be removed for rebuilding the commutator. This is a back shop job.

Other Causes of Flashovers

Repeated flashovers in service are not always caused by rough commutators. Now and then an open circuit in the armature winding will cause trouble. This occurs when a conductor is broken—probably by vibration. Then the current can't get through the winding. An arc is drawn as the segments to which the broken coil is connected move away from each brush. This burns the copper away on both sides of the mica segment and makes a deep trench (Fig. 2). Such damage can easily hide behind a brush holder unless you move the commutator so you can spot it. At high speed and voltage, this arc may carry over between brush holders and cause a flashover. Repairing the open circuit is another job for the back shop.

Low insulation resistance between adjacent commutator bars may be another cause of flashovers. Don't confuse this with a good insulation resistance measurement to ground (such as you make with a "megger"). Remember, the high voltage from one brush to the other is divided between all the mica segments. So each takes care of only a small part of the total. This is why the spaces between bars can be as small as they are. But these spaces must be clean. When they are bridged by enough conducting particles, such as brakeshoe, copper or carbon dust, the current flows across them. The machine can then flash or arc across the commutator from brush to brush. Sometimes only a small section of the commutator will be bridged. Perhaps some grease or oil fell on it. This caused the dirt to collect between a few bars. Once more it is something not easy to find; the rest of the commutator may be clear, so you must move the armature enough to see the whole surface. A spot large enough to bridge only one segment has been known to cause repeated flashovers at high speed and voltage until it was dug out. Don't ignore little things where electricity is concerned—it takes only a spark to explode a keg of powder.

Brushes are expensive and should be left in for as much mileage as possible. However, if you pass brushes so short that they wear out before the next inspection, you will have a service failure. Short brushes transfer the arcing to the brush holder and melt it off. At higher speeds, such arcing can easily make the machine flashover. The condemning limit on brush length varies with

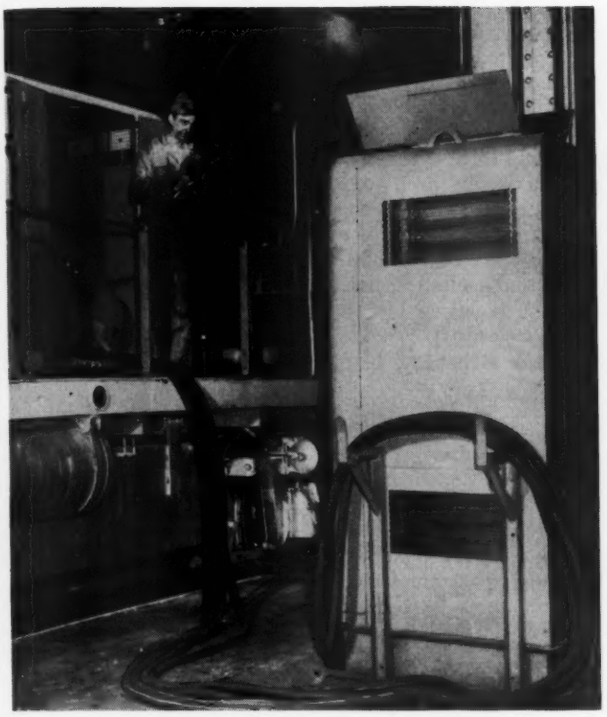


Fig. 7—A portable loading resistor is a handy means of load-testing a locomotive power plant. Load readings can easily be taken from the locomotive platform

the frequency of inspection and operating conditions on your road. When you run into sandstorm, and filtering of the ventilating air is not adequate, brushes can wear down in a hurry. Operating experience is the best guide in balancing brush cost against service failures. Keep records and watch results.

Short brushes are not the only cause of such trouble. Brushes stuck in the carbonways will do the same thing because they can't move to remain in contact with the commutator. Muck dropped on a holder may harden and gum the brushes. Some brushes have been known to swell or sweat and stick themselves in the holders. Even the pig tails bent over the brush holder can hang up a brush—especially on smaller machines where the spring tension may be low.

A pig tail rubbing against the brush holder or against a buzzing spring can be frayed through quickly. Then the broken end is free to wave around. This can cause trouble by dragging on the commutator or against the risers, or by hitting the frame to ground the machine or cause a flashover. Pig tails can also come free of the brush when the corners of the brush break. When making an inspection, it is a good plan to raise the brush spring. Then pull the brush back by taking hold of the pig tail with the other hand. This lets you check the spring tension, the pig tail connection of the brush, the freedom of the brush to move, and to see if the brush is broken. Chips from broken or shattered brushes may get stuck between commutator bars. There they become glowing hot from short circuit currents and can cause a flashover.

After inspection, gently lower the spring and let it force the brush onto the commutator. Don't let the spring snap back as the blow may crack the brush. Where space is limited, as in a traction motor, a springlifting tool (Fig. 3) is a big help. Then both hands don't have to be in the same small space at once. Such a tool is almost a must because of the extra heavy traction-motor spring pressure.

Maintaining correct spring pressure is very important. This is especially so where rail shock and vibration can bounce a brush out of contact with the commutator. Experience with lifting many springs daily gives you a pretty good feel of the correct pressure. Be alert for weak, annealed springs, especially where bad order shunts or pig tails, or burnt springs tip are found. If a new spring is required, the brush holder is usually removed. The spring tension should then be adjusted with a spring scale (Fig. 4) to the recommended pressure. When replacing a brush holder, take care to protect the commutator surface with a pad. Locate the holder in its correct position. By all means see that the cable con-

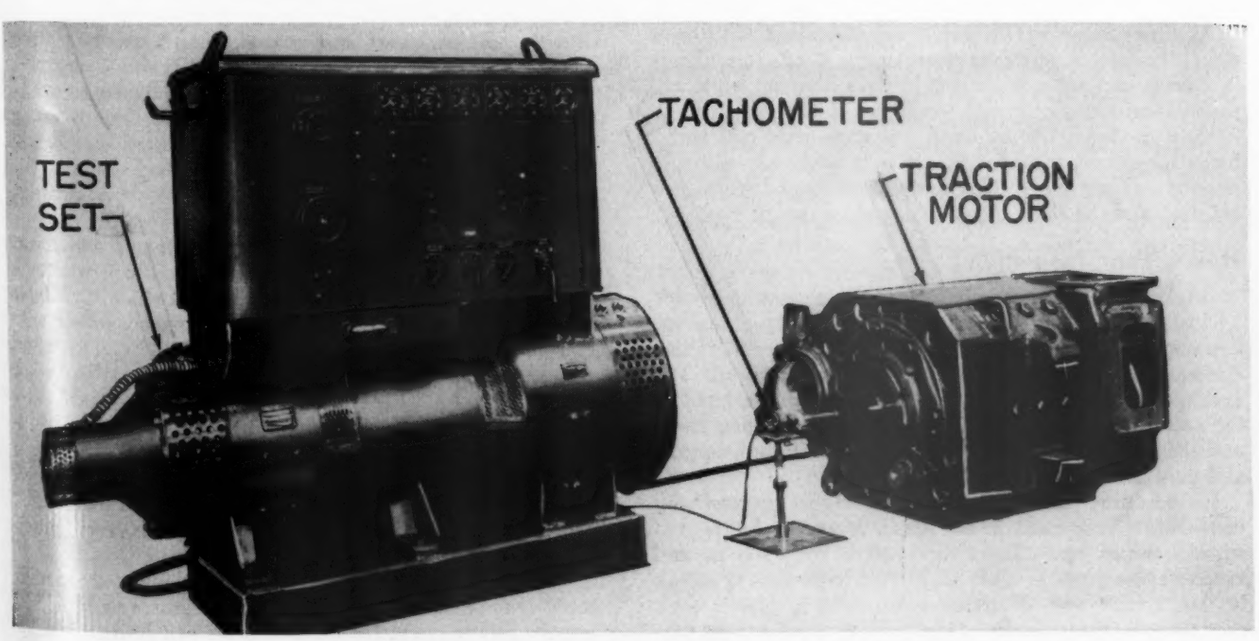


Fig. 6—Special motor-generator set for use in testing traction motors

nection is clean and tightly bolted. Otherwise, there may be enough heating to burn it off when the machine goes into service. This applies to main motor cable connections as well. Locomotive failures have been traced to dirty or loose connections hurriedly or carelessly made.

Watch for Overheating

If you overload a steam locomotive, it will stall. A diesel-electric doesn't act that way. Its generator and motors don't know when to quit. As long as the wheels hold the rails, it will go on pulling. That's what makes it such a brute. But the motors and generator do get hot. If the overload time limit is exceeded, the armatures may get hot enough to melt solder. Molten solder usually throws out like a pinwheel. It splatters on the field coil connections, the frame, or whatever is in line. Beads of solder may also remain stuck to the risers. But, don't confuse this with flashover burns. Look for the silver colored splatter on the frame before making up your mind that the machine was hot enough to throw solder.

A motor or generator may overheat for lack of cooling air. You know what happens to your automobile engine when you lose a fan belt. Check the blowers, their belts or driving motors. Examine the bellows connection between air ducts and the motor inlet. Is there damage which might account for the loss of air? How about the air holes through the armature? They may be clogged with muck and dirt so the air can't get through. Are the motor covers missing? Are they latched tightly enough to hold the required air pressure?

Overheating, no matter what the cause, can do several things to an armature. The contact surfaces of the leads and riser slots can get dull. This will result in high-resistance connections. The current must then fight its way through these connections. This makes hot spots that can damage insulation or even burn off the leads. You can see this trouble because it discolors the risers and leads. Let this serve as a warning.

A worse effect of overheating, because there is no warning, is slackened winding bands. Heat softens insulation which squeezes out from under the band and leaves it loose. Now the winding is free to vibrate. Insulation wears away, or leads may break, and then electrical failure follows.

At times some of the molten solder does not throw clear. Instead it gets caught under the insulation. There it collects and spreads until it bridges between leads and short-circuits them.

Even though an unsoldered armature may pull trains for a long time, it's wise to get it to a shop as soon as possible. Then the leads can be resoldered before they get dull, and the slack bands and wedges can be renewed.

How's Your Insulation?

Insulation condition can be judged surprisingly well by just looking at it. This is because the exposed leakage surface is affected most by conducting dirt layers. These surfaces are usually out where you can see them. For instance, the brush-holder insulators, the string band at the end of the commutator, the insulation between risers and the winding band are all easy to see in both motors and generators.

In operation, these surfaces sometimes get covered with oily dirt. Now and then a flashover blast burns and smokes things up. The tough job is to reach in and around these parts to clean them. Perhaps a dirty streak is left across one of these hard-to-reach places even though everything looks clean. Then someone is surprised when the machine fails in high-potential test or on the road. For this reason, it is a good idea to measure the resistance of the insulation. Several types of megohmmeters are used for this. Some can be plugged into an ordinary light socket. Others are cranked by hand or motor driven. The 500-volt varieties are probably the most popular. They are widely used with excellent results. Now and then, insulation may fail on a high-potential test of 1,000 volts or more even though it has just given a good resistance measurement. Perhaps a 1,000-volt megohmmeter would have shown this defect which did not respond to the 500-volt instrument. Above all, do not paint insulation unless it shows good resistance and also looks clean.

Make a Running Check

Running traction motors up to full speed at every opportunity really pays off. You can listen to the bearings, and check commutator roughness and armature balance. This can be done easily with the motor on the floor. Sometimes the entire motor, wheels, gearing and axle assembly is set up and run. This allows the suspension bearings, axle journal boxes, gears, gear case, and axle and wheel runout to be checked. A welding generator or something like it is the easiest way to get power (Fig. 5a). Such a setup should be securely clamped to the floor.

While this is a fine way of making mechanical checks, it leaves much to be desired electrically. Such a scheme allows only about 100 volts on the motor in order to keep the speed within limits. This is usually about one-tenth of the maximum voltage in service.

A megohmmeter or high-potential test checks insulation resistance to ground. But it doesn't do a thing about the little leakage spaces between the commutator bars. Nor does it check the turn-to-turn insulation of the coils. Surge-type testers are available for overhaul shop use but they don't fit the requirements of running maintenance well. Here the best scheme is an arrangement for running the motor at full or over voltage. In order to get full voltage on the armature, we must have full current through the field. A good way to get this is to connect the main motor field to a high-current, low-voltage generator (a d.c. welder will do as shown in Fig. 5b). Then the motor armature can be run from a high-voltage generator at any desired speed and voltage. This allows you to combine mechanical checks with a full voltage electrical test. It also allows you to air-cure the motor-commutator and reduce the probability of flashovers in service. With covers on the motor and the air inlet closed, the motor will get hot from its own core losses. In fact, you should be careful not to overheat it by prolonged running with all air inlets blocked.

By adjusting the motor field current you can make the armature run at any speed and voltage you want. A portable, self-contained test set with controls is available for this use (Fig. 6). Or, a test set can be put together with equipment usually available on a railroad. The chief problem may be the high-voltage generator. Another traction motor (Fig. 5b) may be used for this by coupling it to an induction motor. Or a couple of 500- or 600-volt machines may be connected in series to get 1,000 or 1,200 volts (Fig. 5c). Locomotive builder's service engineers can help you with such arrangements. The effort of obtaining such a test set is very much worthwhile.

This checking of turn-to-turn insulation in the armature is much easier on a traction generator. By blocking out the power contactors, a generator can be brought up to full speed and voltage with its engine. This is a

quick way to find out if flashover trouble is caused by the generator or by some external fault. Connecting leads from a loading resistor or water box to the generator will allow you to load-test the power plant. Thus, you can put the power plant and cooling system through its paces while you watch and adjust it for best performance. Compact, portable loading resistor sets (Fig. 7) are available for this. Or there are several varieties of water boxes any of which can be built near the testing station.

Field Tips

Field coils and poles usually are not troublesome. Check them for damage by fire. Flashovers sometimes ignite the oily muck plastered between the coils. Blowers feed a forced draft to this fire, and it can do quite a bit of damage before it burns out. Loose field coils on poles are hard to find until vibration wears the insulation through and causes a ground failure. At times, telltale rust between the pole lips and the spring flange collars may serve as a clue. If you suspect shorted turns in the field coils, make a comparative test. Pass enough current through the field circuit to get a suitable voltage reading on each coil. A voltage difference between one coil and the others may point out the bad one. Series motor field coils have too low a voltage on d.c. to give good test results. The accuracy can be greatly improved by making the test with a.c. of 60 cycles or more. Of course, a.c. meters must be used. Also, the brushes should be raised off the commutator so that the armature coils do not act as shorted transformer turns.

When defective field coils are changed out, it is surprising how many times the polarity of the poles is mixed. By all means, check magnetic polarity with a compass or a pair of nails to be sure it alternates from pole to pole.

No Deep Stuff

You can see that the inspection and test of electrical parts on running maintenance is nothing to shy at. It is just as free of "hocus-pocus" as what you do on the mechanical parts. When you understand the job each part does and know what to look for, defects will stand out like sore thumbs and you will spot them immediately. And what can't be seen, can usually be checked by a few simple tests.

Fortunately, most troubles give warning before causing failure. This allows time for preventive action. Efficient and intelligent maintainers understand this, and take advantage of it. Thus, they find that electric equipment is actually reliable machinery—easy to understand and maintain.

Plastic Electrical Tapes In Railroad Service

(Continued from page 86)

Carbonization takes place, and a permanent path of electrical conductivity or "tracking" results. Both No. 33 and No. 22 tape are basically resistant to tracking. Neither will support combustion.

In the electrically operated equipment, such as rotating lights and headlights, limited space makes the thin-caliper tape specially valuable, as several wraps can be applied without creating a bulky joint.

One of the most critical jobs for plastic tape is on the traction motor leads. At the point where the traction motor lead is connected to the feeder cable, a sleeve is slipped over the leads before the mechanical connection is made. The sleeve covers the joint and is held in place by a grooved rack. However, obtaining a moisture-proof seal at this point is a problem. Therefore, plastic tape is used to seal the sleeve to the cable. Usually two layers of lapped tape are used at each end of the tube.

Economy, too, is an important factor. M. C. Sharp, assistant to the general superintendent of motive-power of the Rock Island, states that sealing traction motor tubes was formerly a three-step operation, using insulating materials. Using No. 33 tape, material cost has been cut 30 per cent, and labor cost by 50 to 60 per cent.

The Santa Fe previously used an assortment of four rolls of three different insulating materials for the job, while now a single roll of No. 33 provides the same protection, and in considerably less time.

A number of points in the diesel centralized train control system are protected with tape. The motor generator used in C.T.C. operation requires that the lead joint be taped with several layers of No. 33, and any splicing done within the wiring is also taped.

Moisture is often present in these sealed systems, due to condensation and "breathing". In this instance, a compact, moisture-resistance splice is essential. No. 33 keeps the moisture out and the current flowing in the intended path.

Cab signal receiving coils presents a problem that has been solved by the Illinois Central. C. A. Pearman, electrical engineer of equipment, wanted an outer wrap for the coil that was easy to apply, would provide adequate insulation and provide a moisture barrier. Room was an important item because the tolerances of the assembly were limited. The 7-mil No. 33, applied in a half-lapped layer around the coil, was the solution.

Many of the same problems encountered in diesel wiring also are present in car wiring applications. The insulating wrap where the main car generator leads are joined to the distribution lines must be protected against oil, and the starting battery cables,—as in the diesel locomotive,—have harmful acids to contend with. A half-lapped layer of No. 33 solves both problems.

In the regulator locker panel, individual control wires are taped into neat, trouble-free harnesses protected by a sheath of plastic tape. Pigtail splices used in wiring individual seat lights are given two or three wraps of No. 33, plus an extra length of tape over the pigtail to provide an extra measure of protection.

In the passenger car, as in the diesel, thin insulating material is important where splices must be made in small junction boxes. Railroad electricans frequently comment that by the time a half-inch coduit has been filled with wires, the junction box is too small to make the necessary splices. Using the 7-mil No. 33, however, they can lay the splices back into the box so there is no contact with the sides, consequently no abrasion.

In the cases described, either No. 33 or No. 22 tape is used as a sole insulation. Painting the insulation with varnish is eliminated, since the plastic tape forms a continuous, pinhole-free film. And since aging of an insulation is usually a chemical process, the chemically stable vinyl plastic backing of the tape should, and does, give long service.

EDITORIALS

Extending the Range Of Scientific Oil Testing

When highly scientific laboratory methods of testing lube oil and relating the results of the test to repair work required were first begun on a limited scale, there were a substantial number of railroad men who were skeptical of the need or value of such work. Today the desirability of such work is pretty well accepted. That this type of test work is not done on more railroads is largely for reasons other than lack of faith in what a good lube-oil testing program can do.

A principal and entirely logical objection on the part of smaller roads to the installation of a spectrograph or other advanced laboratory equipment for testing oil is that neither the volume of work that the instrument would handle nor the expected potential savings it would make are sufficient to justify the investment.

Larger railroads, speaking primarily from the standpoint of mileage, sometimes feel that no matter where they might locate a laboratory it would be too far from one or more of the road's scattered terminal points; consequently, the sample would take so long to reach the laboratory that little benefit would result from the test. The sample of oil that would show a defective bearing might, for example, take so long to reach the test point that the crankshaft would be destroyed while the oil was in transit.

Both of these objections could be eliminated by a simple system of joint laboratories at strategic points throughout the country, such as Chicago, Pittsburgh, Washington, Atlanta, St. Louis, Twin Cities and Omaha, to mention some of the largest. The operation could be handled in any number of ways. All the roads using an individual laboratory could jointly share the cost, or every road that contemplated using the services of such an arrangement could join in forming a small company to run the system on an equitable basis for all.

An arrangement of this nature will eliminate the need for small roads making expenditures for equipment that would be in service but a few hours a month. It would eliminate the problem of manning such equipment, and instead would give to the small roads the services of qualified experts who would be working continually, and therefore gaining wide experience, on the problem of lube oil testing and how it can save money on diesel maintenance.

Comparable benefits would accrue to large roads serving vast territories. The time lag between taking a sample and its analysis would be greatly reduced. The joint laboratory could serve to bring together and interchange new thoughts advanced by men from several roads. The best brains in the field could be hired at small cost to any one road. Extensive equipment could be furnished at low pro rata cost, and such equipment would be useful for further developing the science of lube oil testing, and for other fields as well. It could lead to the discovery of how to use economically a diesel fuel of much lower specifications and price than that thought necessary today, which alone would save the railroads far more than the cost of the entire group of laboratories.

Progressive Light Repairs

Some exceptionally pertinent discussion of the advantages of progressive repairs, as compared with spot-system light repairs for freight cars, developed at the April 7 meeting of the Northwest Carmen's Association, St. Paul, Minn., the principal points emphasized being: (1) the necessity for advance planning of the work and provision of necessary tools; (2) pre-selection and line-up of cars in accordance with repairs needed; (3) adequate supervision to catch delays before they become serious and reassign necessary materials or added labor so the entire track movement will not be held up by a single car.

One car foreman started the discussion and argument with the bald statement that he prefers to have cars placed on the repair track at night and stay there until the whole track is repaired. The reason behind this expression by a competent and experienced car supervisor is evidently that freight cars come to the repair track in every conceivable condition, from a few minor defects to broken sills and other serious and extensive damage. Added complications are that the full extent of the repair job is not always evident on first inspection; some cars are loaded and must be given preference over all others regardless of condition.

These difficulties can be met to a certain extent by classifying cars before they are placed on the repair track and one suggestion advanced was that cars be segregated on one track assigned to loads, one to cars needing quite heavy repairs and one or more tracks, as required, to the average run of light-repair work. An advocate of what has come to be generally accepted as the most economical method of giving cars either light or heavy repairs said: "We must not overlook the fact that the biggest gain in repairing light repair cars on progressive tracks is that it almost eliminates the heavy lifting and moving of jacks, horses and heavy equipment and machinery from one place to another, and that kind of work, as performed under the spot system, is entirely non-productive. With the progressive system, we move cars to where the tools and equipment are and not tools and equipment to the cars. I will agree that it is a little easier for the supervisor with the old spot system, but other than that I don't agree."

Special emphasis was placed on the need for adequate tools, most of which are well known on repair tracks. One supervisor, for example, referred to a car puller which he said is really something to see and pulls eleven loads.

Another mentioned fork-lift trucks for moving couplers, wheels, scrap, snow and many other things and said, "We have this type of truck in about 15 places and I believe we could use another one."

One thought expressed by this group of car men and in fact all others working in northern climates is the necessity of doing car repair work of all kinds insofar as possible with some protection from the elements. One supervisor said, "I have been on the repair track and worked when it was 30 degrees below zero and you certainly can't accomplish much when you have to spend half your time trying to keep warm."

As unused steam locomotive shop buildings become available, or new shops can be constructed, a number of progressive roads are equipping them with cranes and other facilities to speed up light car-repair work, reduce costs and meet the competition of other industries which lure away qualified railroad car men and inspectors dissatisfied with their working conditions.

Do Railroad Shops Really Compete?

A railroad shop man, after visiting a number of railroad-operated diesel electrical repair shops, was disappointed with what he found. He said that no one seemed to be cost conscious and that, in his opinion, the majority of the shops should not even exist. Manufacturers' repair shops please note.

His criticism is, in many cases, justifiable, but there are also many good reasons for things being as they are. Every railroad that operates locomotives must have some kind of a shop. When you have a shop, you have overhead, and when you have overhead, you must do some work to justify it. In the process of developing the work, you may have to increase the overhead, and then the question immediately arises, "How far shall I go?"

According to a fairly well accepted theory, the railroad shop should be able to take care of minimum maintenance work, the balance of the work being sent to outside repair shops. In this way, the railroad can maintain a good work load factor and, at the same time, be able to cope with emergencies and also have a means of checking the cost and quality of work done outside. The outside service shop is supposed to be able to maintain a good load factor by serving a number of railroads and perhaps other organizations, needing similar service.

The basic difficulty is that the diesel has come into railroad service so fast. No one has known just what to do, and it has been logical to try to develop methods based on steam locomotive shop experience.

Few experienced electrical men were available. A few have been acquired and many more are being developed. Some of these are young men taken from other industries and even from the farm, who must learn from the ground up. Many came from other branches of railroad service, and the work is frequently more difficult for them because they have much to unlearn.

In the process of developing shops and methods, many new things are being tried. These practices vary widely since shop electrical foremen have insufficient opportunity to learn what the other fellow is doing. Also, there is always the pride one feels in developing something new and better, especially if it is one's own idea.

This procedure generally is necessary. No good shop is ever finished, but the time is here when more attention need be paid to costs and efficiency. Procedures need organization and should be subjected to critical cost accounting if the railroads are to justify the existence of anything more than service shops.

NEW BOOKS

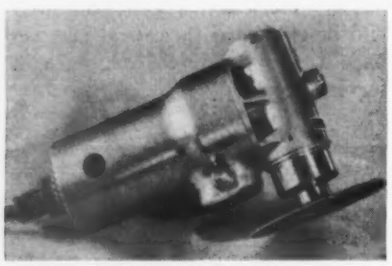
HEATING, VENTILATING AND AIR CONDITIONING GUIDE. *1952 Edition. Published by the American Society of Heating and Ventilating Engineers, 62 Worth street, New York 13. 1,496 pages; Price, $7.50.*

This is the annual revision of the Guide of the American Society of Heating and Ventilating Engineers and, like its predecessors, comprises one of the most complete volumes of its kind published. The technical data section of the current edition comprises 1,064 pages of technical and design information on 50 different subjects. Particular attention is called to the fact that 17 of the 50 chapters in the Guide have been the subject of extensive revision and improvement. While this Guide is primarily of value to those in the building and industrial heating, ventilating and air conditioning field, its basic information is of real value to those who have to deal with the heating and ventilation of shop buildings as well as those concerned with similar problems of air conditioning in railroad passenger cars.

WATER TREATMENT. *By Eskel Nordell. Published by the Reinhold Publishing Corporation, 330 West Forty-second street, New York. 525 pages, 6 in. by 9¼ in. Price $10.00.*

Water treatment to some mechanical department men who are in contact with locomotive operation is to take a cake of this or five or ten pounds of that and throw it into the tank cistern of a steam locomotive or the water supply tanks of a diesel. Most of them appreciate, however, that behind the practical operation is a world of exact chemical science. Mr. Nordell's book is one of those complete analyses of the whole question of water, its supply and its treatment that is done in such a thorough manner that it should open up new fields of interest to the user of treated water and serve as a practical handbook and guide to those who are concerned with the fundamentals of water treatment. This book deals with the impurities in water and the methods of treating them for a great variety of uses. The material is simply and clearly presented to show the basic principles involved and the solution to specific problems. Extensive tables and conversion factors, equivalents and other valuable tabular data make this one of the most complete books on the subject ever published. Two chapters alone out of 18—those on boiler feedwaters and cooling waters—are of particular interest to the operators of both steam and diesel-electric locomotives. The entire book should be of exceptional interest to those mechanical department men who wish to pursue the subject further.

NEW DEVICES



High-Speed Disk Grinder

A high-speed disk grinder designed for one-hand operation, has been introduced by the Balmar Corp., Baltimore, Md., a subsidiary of Franklin Railway Supply Company, New York 17, for use by railroads and railway equipment manufacturers. Called the Diskette, the tool is designed to withstand continuous duty, and polishes, grinds, sharpens and shapes all types of metals.

Its speed of approximately 8,000 r.p.m. enables this 9-in. long industrial tool to be used for a variety of finishing and polishing operations. Because of its light weight of only 4½ lb., it can be operated in close quarters.

Applications in the railway field also include removal of hard carbon from diesel engine pistons and cylinder heads, cleaning outside of cylinder liners, cleaning armature slots in generators and traction motors, removal of paint and rust, grinding down sharp edges of sawed metal parts and sharpening frequently used tools. Special attachments enable it to be used for hole drilling, hole polishing, rotary filing and cutting, solder cutting and even as a small bench grinder.

With its universal motor of 110 volts a.c. or d.c., housed in an aluminum alloy casting, the device is furnished with three composition disks, 4-in. in diameter and 3/32-in. thick of No. 36, 80 and 120 grit as well as a screw driver and a 3/16-in. wrench.

◆

Hot Chemical Jet Cleaner

A cleaning unit known as the Chemo Jet, and able to throw a solid stream of hot chemical and provide a separate high impact jet of water, has been announced by the Sellers Injector Corp., Philadelphia 30, Pa.

This cleaner handles all requirements of the two-step cleaning procedure needed to remove smokehouse deposits, paint, etc. For the chemical step, it provides a 150 gal. per hr. jet of undiluted detergent or solvent depositing a film of liquid on surfaces over 20 ft. away.

Another hose and nozzle assembly enables this unit to shoot a high impact jet of water effective at distances up to 35 ft. All heating and propelling is done within the unit by ordinary plant steam, withaut heaters, pumps or any moving parts.

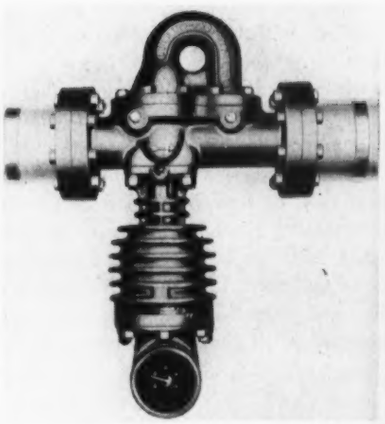
These cleaners are available for wall-mounting, or as portable units with 50 gal. detergent tank.

◆

Steam Meter

A redesigned model SMKS Shuntflo meter for the measurement of steam, air or gas has been announced by Builders-Providence, Inc., Providence, R.I.

This meter, according to the manufacturer, has a streamlined damping chamber to facilitate cooling. Its Meehanite body allows greater strength and durability. It is said to have a simplified rotor mechanism for more efficient operation and easier replacement of parts. It has a strengthened roto shaft to withstand slugs of undue condensate in the line or sudden fluctuations in line pressure.



The device can be utilized by district heating companies and in industry for departmental heating and process work.

Large Diameter Wire Cutter

A latch-type design wire rope cutter has been developed by the Manco Mfg. Co., Bradley, Ill., to supplement their Guillotine line of metal cutting equipment.

This series 15 Guillotine is simple to operate. A click of the latch opens the anvil; material to be cut is laid in position, the main body of tool is raised back to vertical position which automatically locks the tool in the cutting position. Cutting time as little as 7 sec. can be obtained, depending on pump assembly used.

The cutter exerts up to 50 tons thrust and can cut wire rope up to 1¾ in. diameter. Its heavy duty shear-type blades are easily removable for resharpening when needed. The basic cutting unit is available with a variety of electric and air-hydraulic pump assemblies, including foot lever and remote control operations. Weight, 75 lb.

(New Devices continued on page 106)

Old and charge only for rebuilding the latter

TO PUT it plainly, this Unit Exchange Service of Electro-Motive is something no user of General Motors locomotives can afford to be without.

We suggest you check this statement with the many cost-conscious railroads who are now using the plan, and you'll know what we mean.

Briefly, here's how Unit Exchange works:

Immediately on receipt of your order, we ship you a fully rebuilt, fully guaranteed traction motor, engine, generator, blower or other exchange assembly. In most cases it can be delivered in your shop within 24 hours!

You return your old assembly for rebuilding, and when the rebuilding is completed, this unit goes back in our pool ready for shipment. You are charged only for the work and materials needed to bring your old assembly up to the same top-standard condition as the unit you received.

With Unit Exchange, you lose no time waiting for General Motors locomotive assemblies to be rebuilt. Thus, your investment in spares can be greatly reduced.

This factory rebuilding of major components—this Unit Exchange Policy—is another of the many *plus* services railroads have learned to expect from Electro-Motive. It's an essential part of a Lifelong Service Program that helps keep General Motors locomotives on the go for life.

GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS
La Grange, Illinois · Home of the Diesel Locomotive

In Canada: GENERAL MOTORS DIESEL, LTD., London, Ontario

NEW DEVICES

(Continued from page 102)

Heavy Duty Tachometer Heads

Heavy duty tachometer heads, for measuring a wide range of speeds, are now available. These new series 56M units, when used with Metron Tachometer indicators, recorders, or controls can be used for measuring speeds of cement mills and kilns, ball mills, metal working machines, rubber extruders and similar installations. Speeds between 200 and 10,000 r.p.m. for full scale indication are measured by these heads, and they can be overspeeded 2 to 10 times with no damage resulting. They are manufactured by Metron Instrument Co., Denver 9, Colo.

The stainless steel head shaft is ¾ in. in diameter and supported in sealed ball bearings. The head casting is anodized aluminum having a ⅜ in. all. Electrical connections between the head and speed indicator can be up to 1000 feet or more and provisions are made for employing conduit or armored cable. Connections to the head can be made from any of four approaches and the head can be mounted in any position.

Stable performance, according to the manufacturer, is assured over a wide range of temperature, humidity, vibration or magnetic fields. Permanent lubrication for an extreme temperature range is employed throughout.

◆

Extension Rule

A new addition to the line of Lufkin "Red End" rules has been introduced by the Lufkin Rule Co., Saginaw, Mich. It is designated the model X-46F.

Numbering begins at the extension end of the rule, both sides, for flat reading or for regular measurements. The brass extension slide allows inside measurements up to 78 in. A stop prevents the brass slide from coming out.

It is constructed of sections of hardwood. The boxwood finish is protected by a clear plastic coat. Its large bold figures are easy-to-read against the light background. The brass end caps are flush inlaid and riveted. Both edges of both sides of the rule are graduated. The rule is marked consecutive inches to 16ths. Folded length is 8 in.

Dye Penetrant Inspection Process

Development of a dye penetrant inspection process, formulated to serve production-line inspection has been announced by Turco Products, Inc., Los Angeles 1, Calif.

The non-flammable product is called Turco Chek-Spek. Use of this non-toxic solution permits accurate evaluation of parts.

When used in conjunction with a vapor degreaser, the solution requires only two materials—Chek-Spek penetrant (flash point 140 deg. F.) and Chek-Spek developer (flash point 180 deg. F.), Following pre-cleaning by the vapor degreaser, the red penetrant is applied to those parts being inspected. After being allowed to dwell sufficiently long for it to enter the smallest defect, the surface dye is removed by suspending the parts for a few seconds in a vapor degreaser.

Following dye removal, the white developer is sprayed onto the parts being inspected. Strong developer capillary attraction pulls out the dye which has remained trapped in existing flaws. As the white developer dries, the red dye bleeds into it, locating and defining the extent of existing flaws.

The solution is applicable to both ferrous and non-ferrous metals. It can be sprayed or applied by dip or brush.

Metallograph Studies Metal Behavior

Offering both phase contrast and polarized light, this new metallograph can be used by laboratories for the study of anisotropic metals, identification of non-metallic inclusions where polarized light is required, examining unetched specimens or determining differences in level of areas within a specimen.

This desk-type metallograph, model 2400P, has been announced by the American Optical Co., Instrument Division, Buffalo 15, N.Y.

A quadruple revolving nosepiece permits rapid change of objectives. It has an automatic, motor-driven arc lamp which can be adjusted easily and accurately. A separate, built-in illuminator is used for visual examination and four photographic eyepieces operate in a quick-change slide.

A coated reflector is used in the vertical illuminator, yielding plane polarized light free of disturbing elliptical polarization. A slot receives compensators and phase annular diaphragms. Full and quarter wave compensators are standard, making possible striking color differences to accentuate slight differences in contrast.

The device is built into a convenient desk with ample space for storage and taking notes. It is supplied with an adjustable chair, finished in chrome and plastic-covered upholstery.

◆

Antiseptic Creams

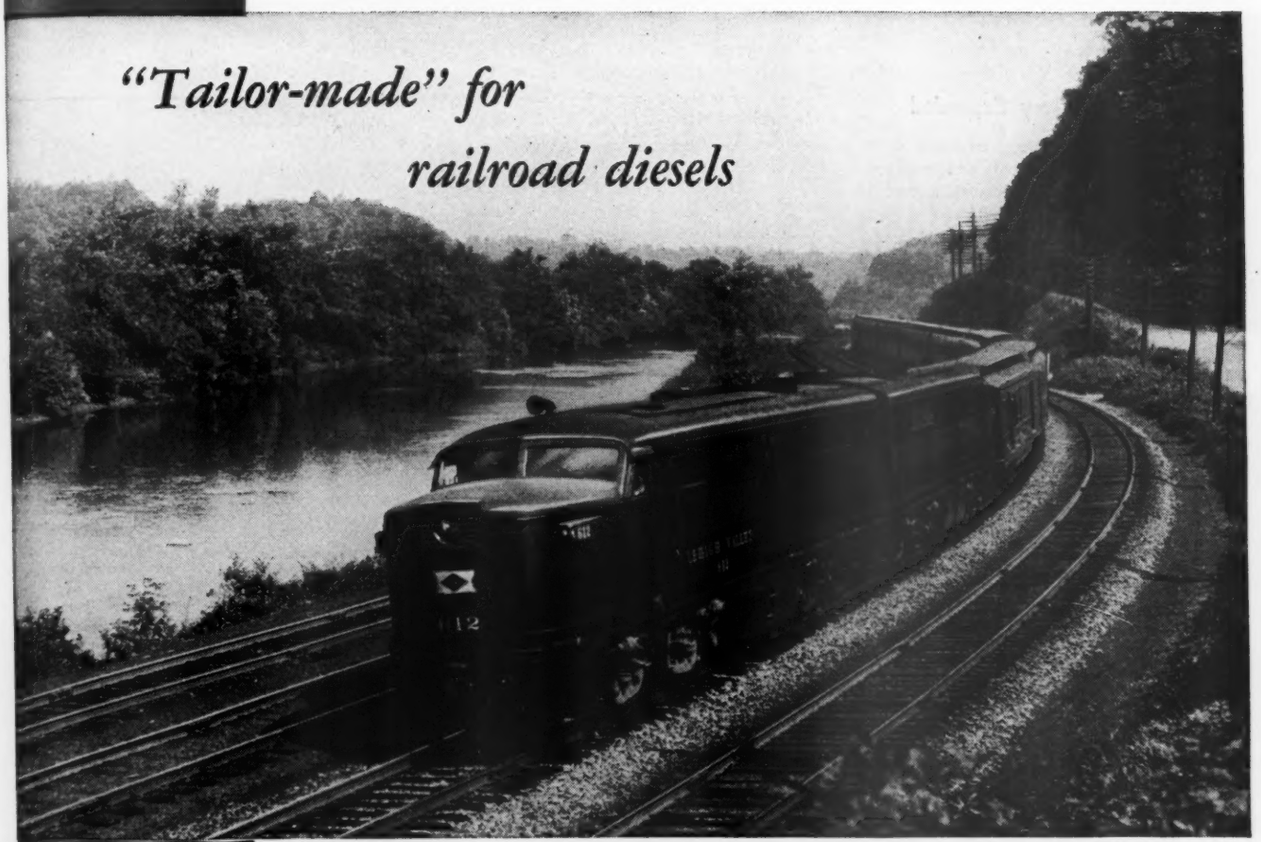
A line of antiseptic protective creams has been introduced to industry by the West Disinfecting Co., Long Island City 1, New York. Containing Hexachlorophene, these creams provide a zone of inhibitation against Staphylococcus aureus and are so formulated as to be almost neutral in pH, thus assuring against irritations from free acids or alkalis.

The creams, packed in 12 oz. tubes for sanitary handling are: #211, an oil resistant, water soluble bland vanishing cream for protection against dust-borne irritants, viscous oils, dirts, greases and grimes; #311, a water-resistant soft cold cream for protection against dilute acids and alkalis; and #411, a solvent-resistant water soluble bland vanishing cream for protection against organic solvents, acetates and cooling and cutting oils of low water content.

In conjunction with the antiseptic, West has designed the Liquicreme Dispenser. Manufactured of polystyrene, the dispenser is designed to dispense a pre-determined amount of protective cream with each stroke of the lever. This unit contains an inner collapsable polyethylene bag which affords protection for the cream.

(New Devices continued on page 122)

Esso Diesel Fuel



Esso Diesel Lubricating Oil

ESSO DIESEL FUEL has been specifically developed to meet the requirements of railroad diesels. Proved on the run in one of the most exacting tests ever conducted through over 300,000 miles of actual operations in a diesel engine. Specify ESSO for an economical, dependable diesel fuel.

ESSO DIESEL LUBRICATING OIL, a high-quality lube for real protection—Diol RD is another famous Esso "tailor-made" railroad diesel product. Developed through years of field testing and research by both engine designers and Esso scientists to meet the needs of diesels—Esso Diol RD helps assure top performance with dependable lubrication protection!

BACKED BY CONSTANT RESEARCH—continuing tests in the lab and on the road make sure that Esso Railroad Products keep pace with progress and latest developments in railroad diesels.

BACKED BY CONSTANT FOLLOW-UP—on-the-job check-ups by Esso Sales Engineers assure the dependable performance of Esso Railroad fuels and lubricants! Be sure to call on ESSO for any railroad fuel or lubricating problem.

The Sign of QUALITY — ESSO — The Symbol of SERVICE

RAILROAD PRODUCTS

NEWS

Corrosion Laboratory Expanded

At a recent conference of editorial representatives of the technical and business press the new facilities recently added to its marine corrosion testing station at Harbor Island near Wrightsville Beach, N. C., were shown by the International Nickel Company. The station provides facilities for the exposure of specimens to attack by sea water under natural conditions, including the erosive effects due to velocity of water through condenser tubes, piping systems, and on pump impellers, propellers, and other parts moving at fast rates through sea water. It also includes studies of the characteristics of materials affecting fouling by marine organisms.

An additional building provides space for a full-size salt-water evaporator and distillation unit, and its accompanying boiler capacity, required to study the effects of water treatment and design on the scaling of such units. It also has a meeting hall with a seating capacity for 72, a machine shop, and office. At Kure Beach, about 15 miles from Harbor Island, a new sea-spray test lot has been set up about 80 ft. from the shore, providing about three times the capacity of the former sea-spray test facilities.

The laboratory at Harbor Island and the marine atmosphere panels at Kure Beach, maintained by the International Nickel Company but utilized by many other producers and users of material, aside from their direct application to sea water and sea atmosphere exposures, have been instrumental in advancing the knowledge of corrosion mechanisms generally and have been productive of information applicable to the alleviation of industrial corrosion problems generally.

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE MAY ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	*No. of units*	*Horse-power*	*Service*	*Builder*
Gulf, Mobile & Ohio	2[1]	1,600	Road switch	Alco-G. E.
Louisville & Nashville	2A[2]	1,600	Freight	Alco-G. E.
	7B[2]	1,600	Freight	Alco-G. E.
	12[2]	1,600	Road switch	Alco-G. E.
	16[2]	1,000	Yard switch	Alco-G. E.
	15[2]	1,500	General purpose	Electro-Motive
	3[2]	1,200	Yard switch	Electro-Motive
Norfolk Southern	5[3]	1,600	Freight	Baldwin-Lima-Hamilton
Utah Railway	3[4]	1,600	Road switch	Alco-G. E.

FREIGHT-CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Delaware, Lackawanna & Western	100	70-ton covered hoppers	American Car & Fdry.
Fruit Growers Express Company	500[5]	50-ton refrigerator	Pacific Car & Fdry.
Norfolk & Western	500[6]	50-ton box	Pullman-Standard
Seaboard Air Line	400[7]	50-ton gondola	Company shops

PASSENGER-CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Chicago, Burlington & Quincy	10	Gallery type suburban coaches	Budd Co.
Ontario Northland	3[8]	Baggage	National Steel Car

[1] Delivery scheduled for August.
[2] Scheduled for delivery during last quarter of this year.
[3] Delivery scheduled to begin late this summer. The locomotives will cost approximately $800,000.
[4] Scheduled for delivery during August and September. To cost approximately $215,000 each.
[5] For delivery beginning the third quarter of this year.
[6] For delivery during the last quarter of this year.
[7] These low-side gondolas are being built on an assembly-line basis from prefabricated parts and are entirely new except for the trucks which have been taken from retired gondola cars. Estimated cost, $1,319,000.
[8] Estimated cost, $240,000. Delivery expected early next year.

NOTES:

Chicago, Burlington & Quincy.—The board of directors of the Burlington has authorized purchase of six 2,250-hp. diesel-electric passenger locomotive units for suburban service. When these units are delivered, the Burlington's Chicago suburban service will be fully dieselized. The board also authorized purchase of 21 road-switching locomotives. These dual-purpose units will cost over $4,000,000 and will be used on both main and branch lines and in yard service.

Nashville, Chattanooga & St. Louis.—The board of directors of the N.C.&S.L. has approved the purchase of three G. P.-7 locomotives from the Electro-Motive Division of General Motors at an estimated cost of $150,000 each.

The International Nickel Company's marine-corrosion test station at Harbor Island, N. C., commonly known as the Sea Horse Institute

David E. Smucker Heads D.T.A. Railroad Division

David E. Smucker, assistant chief engineer of the Pennsylvania, has been appointed director of the Defense Transport Administration's Railroad Transport Division. He succeeds Elmer J. Stubbs, who resigned April 15 to return to his former position as assistant vice-president of the Erie.

N. of M. Creates Special Equipment Department

To supervise repair and reconstruction of equipment, with a view to obtaining maximum use of it, the National of Mexico has announced creation of a special tech-

nical department of motive power and machinery.

Functions of the new department, it is reported, will be: (1) study and appraise probable future demand for railroad transportation in Mexico; (2) study and appraise depreciation of locomotives and other rolling stock; (3) establish a program for acquisition and repair of equipment; and (4) determine the quantity of material needed annually for an adequate repair program. In carrying out these functions, the department also will be charged with working out plans for use of more efficient methods both in repair of existing equipment and acquisition of new equipment.

Three Railroad Sessions at A.S.M.E. Spring Meeting

THREE Railroad sessions are scheduled during the semiannual meeting of the American Society of Mechanical Engineers to be held at the Hotel Sheraton-Gibson, Cincinnati, June 15 to 19, inclusive. The program for these sessions is as follows:

TUESDAY, JUNE 17
2:30 P.M.
RAILROAD I

A Method of Establishing and Comparing Tonnage Ratings of Diesel Locomotives, by E. H. Weston, assistant chief mechanical engineer, Chicago & North Western.

WEDNESDAY, JUNE 18
9:30 A.M.
RAILROAD II

Effect of Impact on Freight Operation Loss and Damage, by W. A. Murphy, freight claim agent, New York, Chicago & St. Louis.

Development in Metallic Friction Draft Gears, by N. T. Olsen, vice-president, Peerless Equipment Company.

Developments in Rubber Draft Gears, by A. M. Bixby, vice-president, Waugh Equipment Co.

2:30 P.M.
RAILROAD III

Developments in Cushioned Underframes, by W. K. Durbon, vice-president, Hulson Co.

Dynamic Testing of Freight Cars, by J. M. Roehm, Pullman-Standard Car Manufacturing Co.

Miscellaneous Publications

RECOMMENDED PRACTICES FOR THE WELDING OF STEEL CASTINGS. Published by Steel Founders' Society of America, Cleveland, Ohio. 40 pages. Price 35 cents. Obtainable also through the Tempil Corporation, 11 West 25th street, New York, without charge to engineers and technicians requesting it on business letterhead. A reference manual for those responsible for the production or, or the repair welding of steel castings. Makes available details of the special operational techniques needed for those steels not as readily weldable as others. Practices outlined as adaptable to the fabricator as to the steel foundryman. Welding Methods, Electrodes, and Recommended Welding Procedure for Carbon-Steel and Low-Alloy Steel Castings each dealt with in a separate section.

SUMMARY OF MONTHLY HOT BOX REPORTS

Month	Foreign and system freight car mileage (total)	Cars set off between division terminals account hot boxes			Miles per hot box car set off between division terminals
		System	Foreign	Total	
July, 1950	2,745,932,894	....	....	23,957	114,619
August, 1950	2,937,455,020	7,422	15,490	22,912	128,206
September, 1950	2,974,297,739	6,541	12,881	19,422	153,141
October, 1950	3,165,997,915	4,343	8,935	13,278	238,439
November, 1950	2,868,871,913	2,536	5,331	7,867	364,672
December, 1950	2,813,042,212	2,278	5,968	8,246	341,140
January, 1951	2,840,847,511	2,870	8,436	11,306	251,269
February, 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951	2,996,562,763	3,702	8,914	12,616	237,521
May, 1951	3,013,634,782	5,631	13,737	19,368	155,599
June, 1951	2,874,873,495	7,074	15,376	22,450	128,057
July, 1951	2,768,920,095	8,886	18,823	27,709	99,929
August, 1951	3,009,371,111	9,023	19,092	28,115	107,038
September, 1951	2,925,570,545	6,472	13,565	20,037	146,008
October, 1951	3,116,490,095	4,131	9,053	13,184	236,384
November, 1951	2,939,503,144	2,022	4,405	6,427	457,368
December, 1951	2,752,316,133	2,130	5,398	7,528	365,611
January, 1952	2,824,298,630	3,208	7,197	10,405	271,437

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

Item No.		Month of January 1952	Month of January 1951
	FREIGHT SERVICE (DATA FROM I.C.C. M-21v AND M-240)		
3	Road locomotive miles (000) (M-211):		
3-05	Total, steam	20,680	28,876
3-06	Total, Diesel-electric	25,655	20,921
3-07	Total, electric	802	838
3-04	Total, locomotive-miles	47,168	50,635
4	Car-miles (000,000) (M-211):		
4-03	Loaded, total	1,647	1,749
4-06	Empty, total	898	852
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):		
6-01	Total in coal-burning steam locomotive trains	37,286	48,862
6-02	Total in oil-burning steam locomotive trains	8,450	11,728
6-03	Total in Diesel-electric locomotive trains	69,369	57,675
6-04	Total in electric locomotive trains	2,135	2,275
6-06	Total in all trains	117,249	120,546
10	Averages per train-mile (excluding light trains) (M-211):		
10-01	Locomotive-miles (principal and helper)	1.04	1.05
10-02	Loaded freight car-miles	38.50	38.50
10-03	Empty freight car-miles	21.00	18.80
10-04	Total freight car-miles (excluding caboose)	59.50	57.30
10-05	Gross ton-miles (excluding locomotive and tender)	2,744	2,653
10-06	Net ton-miles	300	299
12	Net ton-miles per loaded car-mile (M-211)	33.20	32.30
13	Car-mile ratios (M-211):		
13-03	Per cent loaded of total freight car-miles	64.70	67.20
14	Averages per train hour (M-211):		
14-01	Train miles	17.10	16.60
14-02	Gross ton-miles (excluding locomotive and tender)	46,273	43,471
14	Car-miles per freight car day (M-240):		
14-01	Serviceable	44.30	45.50
14-02	All	42.20	43.40
15	Average net ton-miles per freight car-day (000) (M-240)	907	942
17	Per cent of home cars of total freight cars on the line (M-240)	40.40	34.50
	PASSENGER SERVICE (DATA FROM I.C.C. M-213)		
3	Road motive-power miles (000):		
3-05	Steam	8,753	12,584
3-06	Diesel-electric	18,166	16,001
3-07	Electric	1,720	1,715
3-04	Total	28,639	30,300
4	Passenger-train car-miles (000):		
4-08	Total in all locomotive-propelled trains	282,809	292,751
4-09	Total in coal-burning steam locomotive trains	46,743	67,727
4-10	Total in oil-burning steam locomotive trains	27,571	37,565
4-11	Total in Diesel-electric locomotive trains	189,612	169,210
12	Total car-miles per train-miles	9.74	9.58
	YARD SERVICE (DATA FROM I.C.C. M-215)		
1	Freight yard switching locomotive-hours (000):		
1-01	Steam, coal-burning	1,020	1,444
1-02	Steam, oil-burning	174	259
1-03	Diesel-electric[1]	23	26
1-06	Total	4,444	4,691
2	Passenger yard switching hours (000):		
2-01	Steam, coal-burning	38	58
2-02	Steam, oil-burning	13	15
2-03	Diesel-electric[1]	265	246
2-06	Total	350	354
3	Hours per yard locomotive-day:		
3-01	Steam	7.30	8.50
3-02	Diesel-electric	17.10	18.20
3-05	Serviceable	14.60	14.90
3-06	All locomotives (serviceable, unserviceable and stored)	12.60	12.90
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.87	1.85
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.77	0.75

[1] Excludes B and trailing A units.

SUPPLY TRADE NOTES

AMERICAN HOIST & DERRICK CO.—The American Hoist & Derrick Co. has moved its New York district office from 50 Church street, New York, to the foot of Jacobus avenue, South Kearny, N. J.

◆

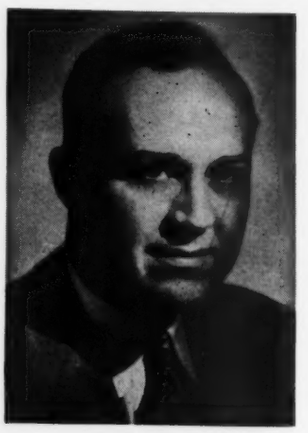
GOULD-NATIONAL BATTERIES, INC.—The Industrial division of Gould-National Batteries, Inc., Trenton, N. J., has reorganized its sales forces in eastern, midwestern and Pacific territories. The move involves creation of regional managerships in Pittsburgh and Detroit, appointment of a coordinator of sales and a manager of headquarters sales, and promotion and reassignment of several field sales executives. *F. A. Miller*, former New York regional sales manager, has been appointed coordinator of sales at the Trenton headquarters, and *Frank Keenan*, of the headquarters sales staff, has been promoted to its managership. Pittsburgh and Detroit territories, hitherto administered by the Cleveland regional office, have become bases for regional sales offices. *O. W. Rider*, former Cleveland district manager, is regional manager at Pittsburgh, and *John P. Kelly*, Philadelphia representative, will manage the Detroit regional office. *Malcolm Janis*, New York representative specializing in telephone, alarm system and control type batteries, has been appointed New York regional manager. *Stanley J. Mahurin*, Denver area representative, has been appointed San Francisco district manager.

◆

H. K. PORTER COMPANY, AMERICAN-FORT PITT SPRING DIVISION.—The *Sneed Sales Company* has been appointed exclusive sales representative in the southwest for the American-Fort Pitt Spring Division. Sneed Sales, which will service accounts in Texas, Oklahoma, Arkansas and New Mexico, is located at 401 North Haskell avenue, Dallas 1, Tex.

◆

AMERICAN LOCOMOTIVE COMPANY.—A new sales office has been opened at 219 East Broad street, Richmond, Va., for the *Railway Steel Spring Division* of Alco. *E. J. Brown* is in charge of the new office as assistant to Vice-President *W. A. Callison*. For the past five years Mr. Brown had been assigned to the Cleveland office of the American Locomotive Company, where he is being succeeded by *W. J. Horstmann*. Mr. Horstmann for the past three years had been assigned to Railway Steel Spring Division sales in New York.



E. J. Brown

W. J. Horstmann, formerly with the Railway Steel Spring Division in New York, succeeds Mr. Brown at the Cleveland sales office.

Mr. Brown, who is in charge of the new Richmond, Va., sales office of the firm's railway steel spring division, became associated with the company in the Chicago sales office in 1935 and for the last five years has been assigned to the Cleveland, Ohio, office.

◆

AMERICAN STEEL FOUNDRIES.—*T. R. Sadler* has retired from the New York office sales department of American Steel Foundries after 47 years' service.

◆

PITTSBURGH SCREW & BOLT CORP.—*Alexander I. Stayman* has been elected vice-president sales.

Mr. Stayman who had been assistant to the president since May 1951 has been with the company for 17 years in the sales division and was manager of sales in the

Ideas for Diesel maintenance

BETTER BACKSHOP CLEANING?

Read how Pennsalt 45-X solved these 3 problems

If you are looking for a heavy-duty backshop cleaning compound . . . a cleaner especially designed for tough soil-removing operations, Pennsalt 45-X may be your answer. This concentrated, free-flowing, virtually anhydrous alkaline silicate-type cleaner has solved many a cleaning problem for some of the country's leading roads. Here are a few typical cases:

Example A

This mid-Western railroad had to clean filters of a tacky oil especially designed for impregnating filter cores. Of the two cleaning compounds already in use, one required 30 minutes for the job; the other failed completely. *Pennsalt 45-X* was tried at 5 oz./gal., 212°F., and cleaned all types sparkling bright *in 5 minutes*, eliminating a serious bottleneck.

Example B

In a new facility servicing 66 Diesel units, Pennsalt 45-X was chosen for use in an 800-gal. steam-heated cleaning tank. Over a 5-month observation period, the 45-X cleaned more than 700 major parts (heads, liners, pistons, gear cases) and hundreds of small parts—fast and efficiently. What's more, the 45-X method cost *less than half* the amount estimated for another process.

Example C

The problem here, as the illustration below suggests, is to clean cylinder liners "factory-clean" in minimum time, and get the locomotive back in service. This before-and-after picture is genuine proof of 45-X's cleaning power and efficiency.

Many more such examples are available in Pennsalt's files. But you are probably more interested in knowing how Pennsalt 45-X can help *your* maintenance cleaning operations. Your nearest Pennsalt service representative is thoroughly trained to help you . . . and equipped to set up tests to determine how Pennsalt Railroad Maintenance Cleaners may give you better, faster cleaning. Write: Maintenance Chemicals Dept., Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

RAILROAD MAINTENANCE CLEANERS BY

Pennsalt Chemicals

PROGRESSIVE CHEMISTRY FOR OVER A CENTURY

Pittsburgh and Southeastern district. He was assistant to the vice-president and general sales manager prior to becoming assistant to the president.

◆

PULLMAN-STANDARD CAR MANUFACTURING COMPANY.—*Fred W. Alger*, assistant vice-president of the Pullman-Standard Car

F. W. Alger

Manufacturing Company, has been appointed to the Birmingham (Ala.) sales office, where he will be associated with the southern district sales vice-president.

◆

CANADIAN RAILWAY PRODUCTS COMPANY.—*Douglas J. Baillie*, formerly with the Canadian Appliance Company, has formed a new sales organization—the Canadian Railway Products Company—with offices in room 912, Dominion Square Building, Montreal. Mr. Baillie recently was appointed agent for W. H. Miner, Inc., of Chicago, to sell their products in Canada.

◆

HUCK MANUFACTURING COMPANY.—*Robert Looker*, of the sales department of the Huck Manufacturing Company, Detroit, has been appointed sales manager, while *Donald Stamy*, formerly an engineer with the Chrysler Corporation, has been appointed assistant sales manager.

◆

TIMKEN ROLLER BEARING COMPANY.—*John F. Byrom* has been appointed sales engineer railway division of the Timken Roller Bearing Company at Minneapolis. Mr. Byrom was formerly sales engineer, railway division at Chicago. All railway division activities both in Chicago and Minneapolis territories remain under supervision of *Paul N. Wilson*, district manager.

◆

MINNEAPOLIS - HONEYWELL REGULATOR COMPANY.—*John A. Robinson* has been appointed sales manager of the Eastern and Mid-Atlantic regions for the industrial division of the Minneapolis-Honeywell Regulator Company. *Joseph J. Matulis* has been appointed industrial manager for the Midwest region to succeed Mr. Robinson, and *C. G. Behnke*, industrial manager of the Chicago branch office.

◆

THERMO-KING RAILWAY CORPORATION.—The *United States Thermo Control Company* has announced formation of a subsidiary, the Thermo-King Railway Corporation, to handle railway sales of its au-

S. MacClurkan

tomatic car refrigerating systems. The subsidiary will have offices at 80 East Jackson boulevard, Chicago 4, under direction of *Samuel MacClurkan*, vice-president. Mr. MacClurkan was formerly manager of railway sales for the Pyle-National Company.

◆

BLACK & DECKER MFG. CO.—Five district sales managers for the United States and one for Canada have been appointed by the Black & Decker Mfg. Co. as follows: *E. M. Stuart* for the northeastern region; *A. Lee Proctor*, southeastern; *Raymond G. Horner*, central; *Wm. L. Poynter*, midwest; *Arthur S. Boehm*, Pacific coast, and *Donald S. McKeracher* for Canada. These men were formerly territory branch managers in Boston, Atlanta, Chicago, Kansas City, San Francisco and Montreal, respectively. They will report to the general sales manager at Towson, Md.

◆

MCKAY COMPANY.—*C. Louis Freeze* has been appointed district sales representative in Delaware, eastern Pennsylvania and southern New Jersey for the Electrode Division of the McKay Company.

◆

WALL COLMONOY CORPORATION—*Anthony J. Allen* has joined the Wall Colmonoy Corporation as eastern sales manager, with headquarters in New York. Mr. Allen will be in charge of sales on the Eastern Seaboard.

◆

WAUGH EQUIPMENT COMPANY.—*Arthur M. Bixby* formerly assistant to president of the Waugh Equipment Company has been elected vice-president of the company.

Mr. Bixby was a special mechanical apprentice with the New York, New Haven &

A. M. Bixby

Hartford in 1925-28 and subsequently worked in the test department; as assistant to mechanical engineer; and as mechanical assistant in the research department. He became associated with Waugh Equipment in 1939 as a service engineer.

◆

ALUMINUM COMPANY OF AMERICA.—*C. F. Nagel, Jr.*, chief metallurgist, has been elected a vice-president of Alcoa.

McDOUGALL-BUTLER COMPANY.—*Edward J. Butler* has been elected president of the McDougall-Butler Company to succeed his father the late *Andrew S. Butler. Herbert J. Miller,* executive vice-president, has been appointed also general manager. *H. Vernon Smith* has been appointed southern sales director and elected vice-president.

F. G. Penl

Frank G. Penl, sales manager of Transportation Finishes of the McDougall-Butler Company of Buffalo, N.Y., has been appointed sales manager. Mr. Penl will continue to assume the responsibilities of Transportation Finishes in addition to supervising all other sales activities of the company.

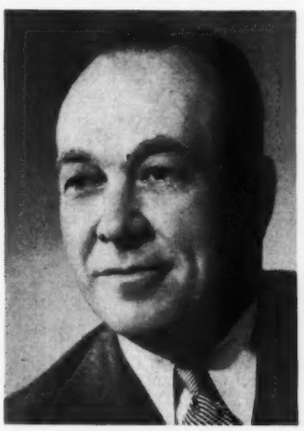
◆

INTERNATIONAL NICKEL COMPANY OF CANADA.—*Paul D. Merica,* executive vice-president and a director of the International Nickel Company of Canada, has been elected president to succeed *John F. Thompson,* who will continue as chairman of the Board and chief officer of the company. *J. R. Gordon,* assistant vice-president, has been appointed also assistant general manager, and in these capacities will manage all Canadian activities under the direction of *R. Leslie Beattie,* vice-president and general manager, whose headquarters are now at Toronto, Ont.

Mr. Merica has been elected also president of the *International Nickel Company,* United States subsidiary of International of Canada. Other executive changes in the U. S. subsidiary are: *Walter C. Kerrigan,* vice-president, has been elected to the newly created position of vice-president and general sales manager, responsible for both nickel and mill products sales, with *L. R. Larson,* elected assistant vice-president and assistant general sales manager. *Theodore H. Dauchy, Richard A. Cabell* and *John A. Marsh* have been named to assistant vice-presidents.

◆

PYLE-NATIONAL COMPANY.—*Charles H. Hobbs,* formerly district manager at St. Louis for the Pyle-National Company, has been appointed manager of railroad sales, with headquarters in Chicago. Mr. Hobbs succeeds *Samuel MacClurkan,* who has resigned. *Robert P. Underwood* has been transferred from the Chicago sales office to



C. H. Hobbs

St. Louis; *Harland R. Benike,* temporarily engaged in special work in the headquarters sales office in Chicago, has returned to his former position as sales representative in St. Paul. *Robert R. Andersen,* who relieved Mr. Benike in St. Paul, has been transferred to Chicago, to handle special assignments.

◆

GUSTIN-BACON MANUFACTURING COMPANY.—The Gustin-Bacon Manufacturing Company has extended the distributing territory of the *Western Fiberglas Supply Company* of San Francisco to include the entire Pacific coast and Alaska. Western Fiberglas has opened new offices in Seattle, Wash., and will soon add branch offices in Spokane, Wash.; Portland, Ore., and in Alaska.

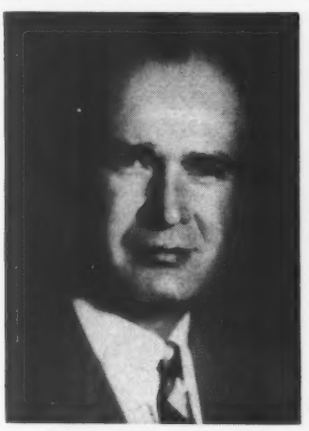
AMERICAN CAR & FOUNDRY CO.—*Philip A. Hollar* has resigned as deputy under secretary of commerce for transportation and has returned to his position as vice-president of the American Car & Foundry Co.

Mr. Hollar served as a consultant to the Defense Transport Administration for several months prior to his appointment as deputy under secretary in April 1951. He has been with American Car & Foundry since 1946, and from 1942 to 1945 was with the Association of American Railroads.

◆

WESTINGHOUSE AIR BRAKE COMPANY.—*W. Lyle Richeson* has been elected vice-president of Westinghouse Air Brake. Mr. Richeson was formerly vice-president of the American Car & Foundry Co., New York.

Mr. Richeson completed three years in mechanical and electrical engineering at Tulane University and is a graduate (1924) of Sheffield Scientific School, Yale Univer-



W. Lyle Richeson

sity where he received the degree of bachelor of science in administrative engineering. His business career has been devoted to the railroad supply field. He became associated with American Car & Foundry in 1925 and advanced in the sales organization by establishing the Cleveland office where he was successively district agent, representative and sales manager. Later he became manager of sales at New York, then assistant vice-president and vice-president in sales.

◆

CLARK EQUIPMENT COMPANY.—*Vernor*

L. Johnson, associated until recently with the Studebaker Corporation, has been appointed regional sales manager of the Clark Equipment Company's northeastern region, with headquarters at 165 Broadway, New York.

◆

UNION CARBIDE & CARBON CORP.—*Morse G. Dial* has been elected president of the Union Carbide & Carbon Corp., to succeed *Fred H. Haggerson*, who continues as chairman of the board; *Walter E. Remmers* as vice-president, alloys Division, Union Carbide & Carbon. Mr. Remmers, who joined Union Carbide in 1936, has been president of Electro Metallurgical Company since 1948, and president of the United States Vanadium Company since 1950, both divisions of Union Carbide & Carbon.

Kenneth I. Thompson has been appointed vice-president—sales of the *Oxweld Railroad Service Company*, a division of the Union Carbide & Carbon.

Mr. Thompson entered the industrial equipment business in 1921 with the Pennsylvania Pump & Compressor Co. and later worked for the Lehigh-Fuller Company. In 1937 he was associated with Ingersoll-Rand and in 1945 he joined Oxweld Railroad Service as eastern sales manager. Mr. Thompson was appointed general manager in 1950, with headquarters in Chicago.

◆

JONES & LAMSON MACHINE CO.—A new, full-color sound 16-mm motion picture, "What's the Difference?" has been released by Jones & Lamson Machine Company, Dept. 710M, Springfield, Vt. The film, with a 21-min. running time, tells the full optical comparator inspection story—from "comparison" to "precision measurement"—with production line scenes taken in other plants under working conditions. Bookings for the loan of this movie can be made by schools, technical associations, manufacturers, quality control groups, etc.

◆

UNITED STATES STEEL CORPORATION.—*Benjamin F. Fairless*, president of the United States Steel Corporation, has been selected to receive the John Fritz Medal and Certificate as "Champion of the American Free Enterprise System for Notable Industrial Achievement in the Production of Steel." The medal is perpetuated by the A.S.C.E., A.I.M.M.E., A.S.M.E., and A.I.E.E. as a joint honor for scientific or industrial achievement in any field of pure or applied science.

The *United States Steel Company*, a subsidiary of the United States Steel Corporation, at Pittsburgh, has established a transportation department which will be responsible for coordinating transportation services to meet all plant requirements. *J. W. Hoover*, formerly general traffic manager, has been appointed general transportation manager, manufacturing division.

◆

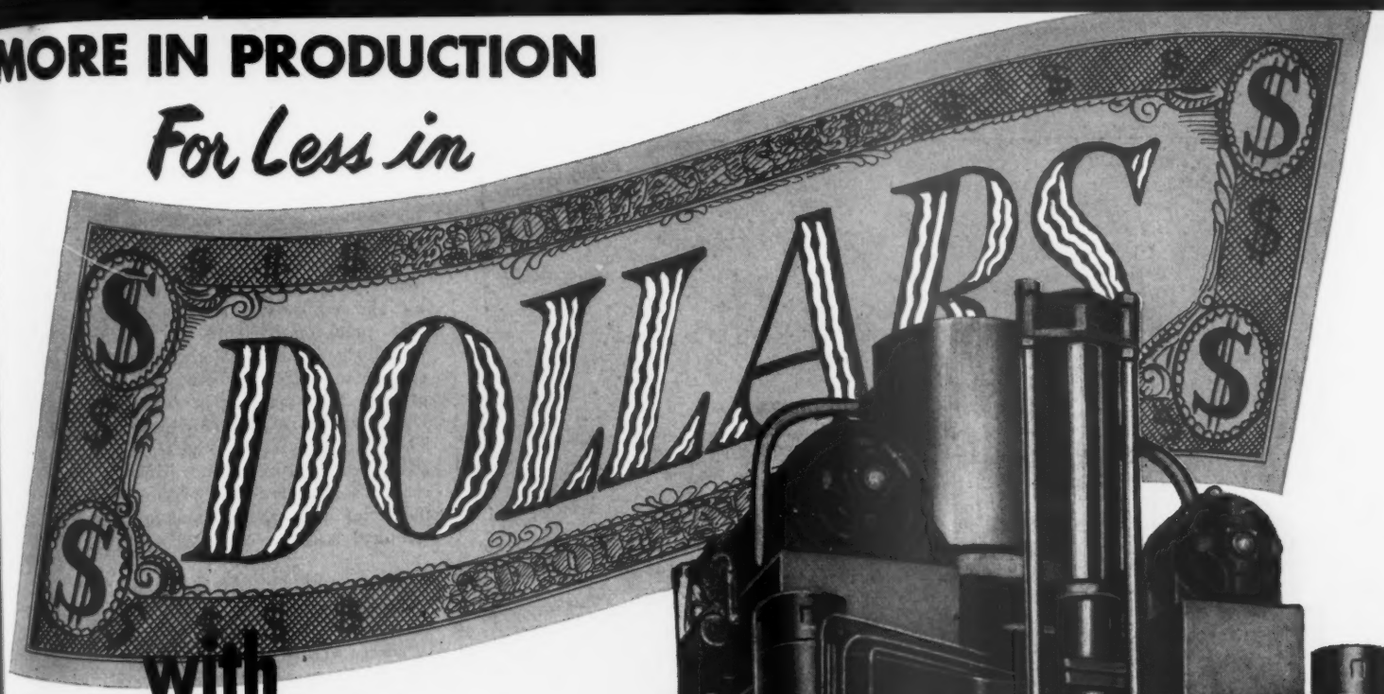
SCULLIN STEEL COMPANY.—*T. H. Parke*, former assistant vice-president in charge of the New York office of the Scullin Steel Company, has been appointed vice-president.

◆

AIRCRAFT-MARINE PRODUCTS, INC.—Two new educational motion pictures which dramatically illustrate the uses, application, inspection and quality control of solderless

MORE IN PRODUCTION

For Less in

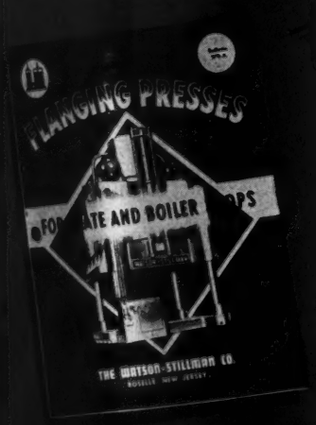


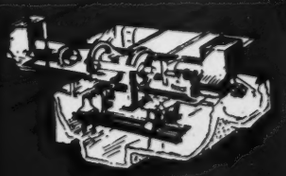
with W-S CAR SHOP FLANGING PRESSES

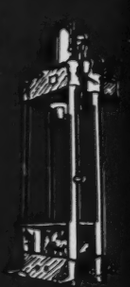
Your current drive for production economy has two sides. You must produce what you *are* producing for *less;* or you must produce *more* without proportionately increasing your costs. Either of these objectives could be replaced by its alternative almost overnight . . . but with material and labor costs what they are, it's a cinch you'll be shooting hard at *one* of them for many years to come.

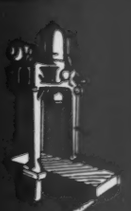
W-S Flanging Presses can help you save *either* way—on current production rates or on increased volume and advanced delivery deadlines. Furthermore, they're designed to give you that help for the many years of service which now, more than ever, you must expect of capital equipment.

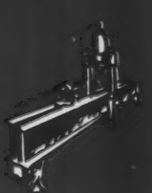
Minutes and cents lost in the shop may pyramid into hours and dollars on the rails. Make your next new-plant investment *count*—see a W-S representative, or write direct for Bulletin 570-A, W-S Flanging Presses.











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W-S "COMPLETELINE" HYDRAULICS . . . THE SHORTEST DISTANCE FROM PRODUCTION TO PROFITS

2-M-2

terminals for stranded or solid wire have just been produced by Aircraft-Marine Products, Inc., 2100 Paxton street, Harrisburg, Pa. These 16 mm sound films, in color, cover two different aspects of the solderless wire termination story. "All's Well That Ends Well" demonstrates the use and application of solderless terminals with precision hand tools. "By the Millions" shows how solderless terminals in continuous strips can be applied at speeds of up to 4,000 per hour in mass production with specially designed automatic machines. The films are intended primarily for instructional purposes, but will also be presented before trade association meetings, industrial groups, and engineering and technical schools.

◆

WESTINGHOUSE ELECTRIC CORPORATION.—*W. W. Sproul*, sales manager, industrial products, has been elected vice-president in charge of the company's general industrial products group of divisions which comprise the Micarta, standard control, small motor, elevator, Sturtevant, welding and lighting divisions, and the Bryant Electric Company. *L. B. McCully*, manager, in charge of East Pittsburgh divisions (transportation and generator, and switchgear), has been elected vice-president in charge of the same divisions. *H. E. Seim*, general manager of the Sturtevant division and the Bryant Electric Company, has been appointed vice-president in charge of the Sturtevant division at Boston.

◆

AMERICAN BRAKE SHOE COMPANY.—*Stephen S. Conway* has been appointed first vice-president of the *Brake Shoe and Castings Division* of American Brake Shoe.

S. S. Conway

Mr. Conway, who has been with American Brake Shoe since 1912, will continue also as vice-president in charge of sales for the Brake Shoe and Castings and Southern Wheel Divisions.

◆

REYNOLDS METALS COMPANY.—The Reynolds Metals Company has appointed the *Vinson Supply Company*, Dallas, Tex., and *Very's Brothers, Inc.*, Columbus, Ohio, as distributors handling Reynolds' general line of aluminum mill products.

◆

WORTHINGTON CORPORATION.—The Dunellen, N. J., plant of the Worthington Corporation, has been redesignated as the Plainfield Works, Plainfield, N. J.

"Right Dress" for Diesel-Electric AUXILIARY EQUIPMENT

NATIONAL
TRADE-MARK

Standardized Brushes

ECONOMICAL maintenance demands the *best in brushes* for your diesel-electric locomotive auxiliary equipment, just as it does for diesel-electric main generators and traction motors. That's why National Carbon has standardized all down the line ... now offers you the full advantages of purchase from stock with its consequent uniform quality, low cost and quick delivery on the standardized auxiliary brushes listed below.

Like other "National" Carbon Brushes, STANDARDIZED auxiliary equipment brushes *cost less* – any way you look at it. *Uniform dependability* means lot-to-lot freedom from breakage, shunt-loosening or other brush failures. *Commutator maintenance* is reduced by service-proved grades. High electrical and mechanical *efficiency* contribute to operating economy. All together, they mean *longer brush life.*

"National" Standardized Brushes for D-E Locomotive Auxiliary Equipment

BRUSH NO.	SIZE	GRADE
NC 16-3220	1¾ x 1 x ½	SA-3538
NC 16-5622	1¾ x 1¾ x ½	259
NC 20-3220	2 x .993 x .618	259
NC 08-3216	1¾ x 1 x ¼	SA-45

LOW LIGHT BILLS...

... mark phenomenal acceptance of the "EVEREADY" No. 1050 Industrial Flashlight Battery by a broad cross-section of industry. Delivering *twice the usable light* of any battery we've ever made before, it will not swell, stick, or jam in the flashlight ... has no metal can to leak or corrode.

DON'T FORGET... "NATIONAL" STANDARDIZED BRUSHES GIVE YOU A BETTER PRODUCT... IN A BETTER PACKAGE... AT A BETTER PRICE!

ADD THEM UP! THEY TOTAL THE FINEST BRUSH MONEY CAN BUY.

BUY NATIONAL STANDARDIZED BRUSHES FOR MOST EFFICIENT MOTOR AND GENERATOR OPERATION.

Obituary

WALLACE B. PHILLIPS, president of the Pyrene Manufacturing Company, Newark, N. J,. died on April 14 at Roosevelt Hospital, New York. Mr. Phillips was born in New York on March 30, 1886. In 1912, he

Wallace B. Phillips

went to England as chairman and managing director of the Pyrene Company, Ltd., returned to the United States in 1950 to become executive head of the parent company.

CLARENCE C. RAUSCH, assistant vice-president and manager of rust preventive sales for the Dearborn Chemical Company, Chicago, died on April 29 in Houston, Tex. Mr. Rausch had been with the firm for 32 years, serving as assistant vice-president since 1941 and manager of rust preventive sales since 1950.

PERSONAL MENTION

Canadian National

H. J. BETTS, electrical engineer-equipment, Montreal, appointed electrical engineer, Central region, with headquarters at Toronto, Ont.

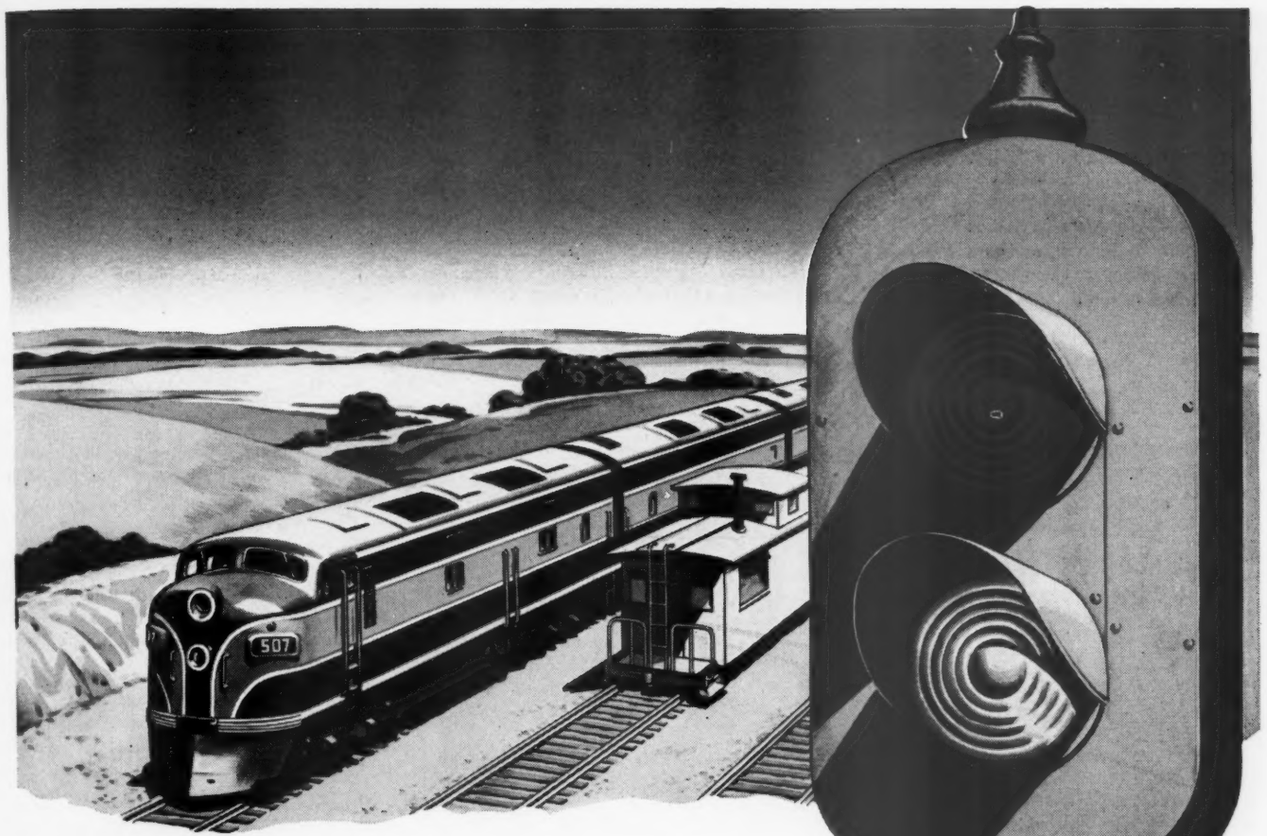
Chicago & North Western

H. H. MAGILL, acting superintendent of motive power, Northern district, appointed superintendent motive power, with headquarters at Chicago.

Chicago, Milwaukee, St. Paul & Pacific

F. A. UPTON, master mechanic at Chicago, appointed assistant superintendent of motive power at Milwaukee.

R. E. MAGNUSON, assistant master mechanic at Chicago, appointed master mechanic, Chicago.



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There's No Profit in Standing Still!

Diesel powered "Yard Goats" and main line "Hogs" only eat up revenue in the shops. Wix Engineered Filtration keeps them out in the money-making territory with Filter Cartridges *Engineered* to your service, road conditions and filter change schedules.

WIX Filter Cartridges offer you a choice of proven mediums . . . the famous interlapped white cotton thread . . . colored waste . . . resilient density blends and a special *new* filtrant. All feature electronically controlled density! All feature reinforced end-to-end construction . . . no slump, no squash, vibration proof!

Write for particulars on what these low cost, high performance cartridges can do for you!

wix TRADE MARK REG.

ENGINEERED FILTRATION

RAILROAD OIL FILTERS

WIX ACCESSORIES CORP. • GASTONIA, N. C.

WIX ACCESSORIES CORP. LTD. • TORONTO, CANADA

WAREHOUSE STOCKS IN: GASTONIA • ATLANTA • ST. PAUL • CHICAGO • CLEVELAND • ST. LOUIS • OAKLAND

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ROY H. WEBER RY. APPLIANCES SAN FRANCISCO

Chicago, Rock Island & Pacific

A. G. MUELLER, general air-brake supervisor at Chicago, has retired.

L. F. LAROTONDA, assistant diesel supervisor at Silvis, Ill., has been appointed air-brake supervisor, with headquarters in Chicago.

Delaware & Hudson

GEORGE H. BROWN, assistant superintendent of equipment (locomotive) at Albany, N. Y., has retired.

Elgin, Joliet & Eastern

JOHN P. FITZGERALD, road foreman of engines and assistant trainmaster, has been appointed system supervisor of air brakes, with headquarters at Joliet, Ill.

BERNARD J. TYRELL has been appointed road foreman of engines and assistant trainmaster, Joliet division, with headquarters at Joliet, Ill.

Erie

CHARLES W. ROSSA, road foreman of engines, Kent division, at Kent, Ohio, appointed road foreman of engines, Susquehanna and Tioga divisions, with headquarters at Hornell, N. Y.

RICHARD R. MITCHELL, assistant to supervisor locomotive operation at Hornell, N. Y., appointed road foreman of engines, Kent division, with headquarters at Kent, Ohio.

Illinois Central

JOHN S. WRAY appointed assistant to general superintendent at Chicago.

New York Central

J. J. LARSON, assistant master mechanic (car) at Buffalo, appointed general car inspector at New York.

D. J. BOURNE appointed general foreman at Englewood enginehouse, Chicago.

E. H. WRIGHT appointed assistant master mechanic, Michigan Central district, with headquarters at Detroit, Mich.

Southern

HENRY E. DYKE, master mechanic at Selma, Ala., appointed master mechanic at Meridian, Miss. Position of master mechanic at Selma abolished.

AURBEY M. CARY, assistant master mechanic at Birmingham, Ala., appointed assistant diesel superintendent at Washington, D. C.

HOWARD G. HEINZ, foremain air brakes at John Sevier, Tenn., appointed air-brake instructor at Knoxville, Tenn.

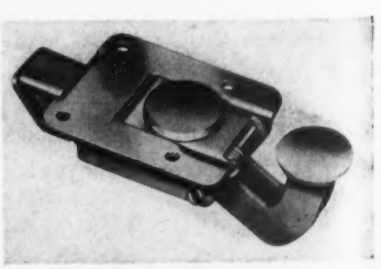
CECIL D. SCHWINE, JR., appointed assistant master mechanic at Birmingham, Ala.

KENNETH L. GENTRY appointed foreman air brakes at John Sevier, Knoxville, Tenn.

H. WILBUR SANDERS appointed assistant foreman enginehouse (day) at Greensboro, N. C.

NEW DEVICES

(Continued from page 106)



Push Button Flush Latch

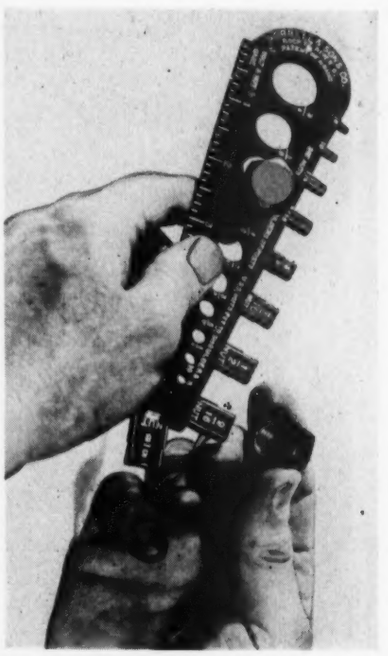
A flush latch, designated part No. H-4100 has been introduced by the Hartwell Co., Los Angeles, Calif. This device is designed for a variety of industrial, transportation and commercial applications.

The unit mounts completely flush, the

only exposed parts are the recessed, circular trigger button and close button. Finger-tip pressure opens the latch. As the forward button is depressed, the rear button raises, providing a grip for opening the door.

These latches are available in stainless steel, cadmium plated cold rolled steel or aluminum alloy and weigh from 0.7 to 2 oz. according to material.

◆



Pocket Style Bolt and Nut Gage

A light-weight pocket style bolt and nut gage has been announced by Sorrell & Sons Co., Rocky River 16, Ohio. Made of wear-resisting polystyrene plastic in bright colors, the device will gage bolts and screws from #8 through ¾ in. dia., nuts from #8 through ⅝ in. dia.

Bolts are gaged by pushing them through the size holes and the nuts by dropping them on the "plugs" on the top edge of the gage. The plug gages tell not only the diameter of the nut but tell whether it is coarse thread or fine thread.

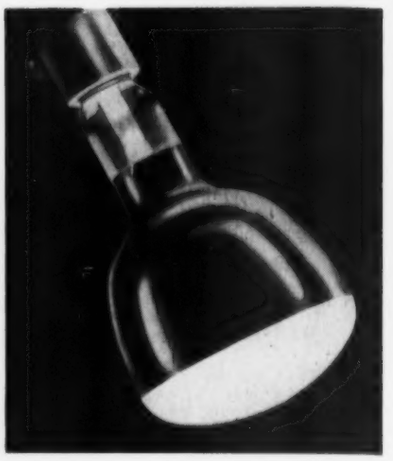
Accurate to 0.005 in. tolerances, the gage measures only 7¼ in. overall.

◆

Machine Tool Magnetic Chuck

The advantages of magnetic chucking have been made available for smaller machine tools and for bench work through the addition of three small electromagnetic chucks to the line of devices manufactured by the Hanchett Magna-Lock Corp., Big Rapids, Mich.

These magnetic chucks in sizes of 5 by 10 in., 6 by 12 in., and 6 by 18 in., facilitate holding work pieces for hand sawing, scraping, layout, filing, welding,



have a life rating of 3,000 hr. at 5 hr. per burning start, and 4,000 hr. at 10 hr. per start.

One lamp, the H400-R1, generates light of the regular mercury color. It has a lumen output of 14,500 and carries a list price of $24.00. The other lamp, the H400-RC1, is physically the same except for a coating of phosphor on the inside face of the outer bulb. This improves the color quality of the light, particularly in its effect upon the human complexion, and helps smooth out the light beam. The lamp has an output of 10,000 lumens, and its list price is $28.00.

The new mercury lamps are companions to the R-52, 500- and 750-watt reflector high-bay filament lamps introduced a year ago, and are expected to be used with them in many installations. The R-52 lamps give substantially even illumination when the space between units is not greater than the height at which they are mounted. The bulbs should be shielded against falling water, and for best performance should not be touched by accessory equipment.

◆

Shaft-Mounted Speed Reducer

Recently introduced is a new unit, a double-reduction shaft-mounted speed reducer

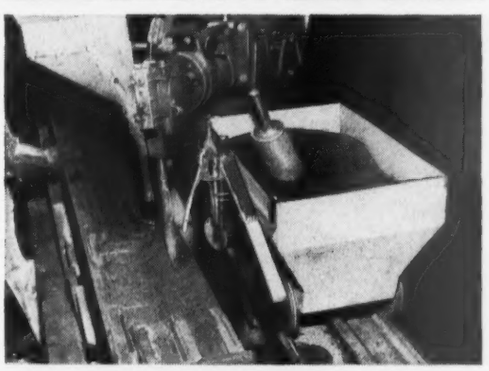
Step Up Car Building with Unionmelt Trade-Mark Welding

Major car building programs have included UNIONMELT welding for years.... And every month, railroad shops all over the country are adding more and more efficient and economical UNIONMELT installations. The reason is plain and simple: UNIONMELT *welding means higher production at lower cost.*

Here are just a few reasons for including UNIONMELT welding in car building programs:

91 ft. of strong welds are made in less than 8 minutes welding time on these baggage car side sheets... The UNIONMELT installation used in this efficient setup makes 13 different welds – requires little manipulation.

Sound welds between the web and top plates of these car bolsters assure stronger, better cars ... A UNIONMELT machine makes the welds between the ¼-in. web and ⅜-in. steel cover plates at about 35 in. per minute.



In order to make cars strong, parts are welded into the sill making them integral with it. This UNIONMELT setup has no trouble making the required welds for the rear draft lugs, through slots in the sill.

Where joints were previously not adaptable for automatic welding, the UNIONMELT flexible machine now makes clean, sound welds.

If you would like to know more about UNIONMELT welding and car building, send for booklet F-7767.

OXWELD RAILROAD SERVICE COMPANY
A Division of Union Carbide and Carbon Corporation
UCC
Carbide and Carbon Building Chicago and New York
In Canada:
Canadian Railroad Service Company, Limited, Toronto

OXWELD RAILROAD SERVICE

SINCE 1912—THE COMPLETE OXY-ACETYLENE SERVICE FOR AMERICAN RAILROADS

The term "Unionmelt" is a registered trade-mark of Union Carbide and Carbon Corporation.

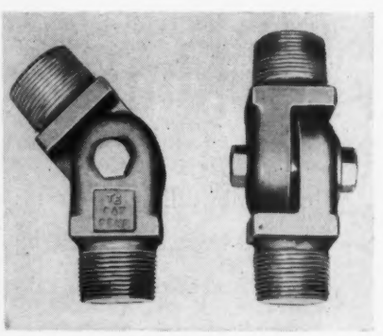
with a capacity to 43 hp. and for output speeds from 12 to 110 r.p.m. It is a product development of the Dodge Mfg. Corp., Mishawaka, Ind.

This device, the No. 7 Torque-Arm Speed Reducer, brings the number of sizes in the manufactured line to eleven—divided in two series, single and double reduction.

The reducer has a 59 per cent greater hp. capacity than the No. 6. Like other models, it is shaft-mounted and anchored with a torque arm which fastens to any fixed object. A turnbuckle enables fast, easy adjustment of belt tension. Installation is simple as there is no foundation to provide and no flexible couplings are required.

In a typical application, illustrated, the reducer is mounted on the shaft of the solid steel head-pulley of a sand belt conveyor. Here, the anchoring arm is equipped with the Dodge Tri-Matic overload release. In the event of overload, the release trips; instant action loosens the belts, cuts off power and gives an alarm.

◆



Adjustable Angle Suspension Fitting

The Thompson Electric Company, Cleveland, Ohio, has just announced a new adjustable angle fitting which permits accurate vertical suspension of overhead type electrical equipment from sloping or arched roof members. This unit features 90-deg. adjustment and also permits angle mountings from wall posts or columns. Originally developed for use with Thompson disconnecting-lowering lighting fixture hangers, it can be used to suspend other types of lighting units, loud speakers, unit heaters, overhead fans, blowers, motor platforms, and other electrical equipment weighing up to 1,500 lb. When utilized with floodlights, this fitting facilitates balancing in any vertical or radial position so that lights can be focused independently.

The adjustable angle fitting is fabricated of high-strength heat-treated aluminum alloy with machined conical seats for hard, radial knurled double-cone plugs which join the halves. The parts are keyed into position after adjustment by tightening the draw bolt. When set, the fitting will hold its position up to the maximum load capacity of the component parts.

The fitting is available in three types. The light-duty model has ¾-in. male pipe threads and is designed for units weighing

Available with two carriages for machining wheel seats, dust guard surfaces, journals and collar; or with 4 carriages for turning complete axles. Leaves no jaw indentations.

NILES can *cut* your axle-machining time in 1/2

This Niles end drive axle lathe—with its fast, easy set ups, accessible controls, modern feeds and speeds—is a truly *high-production* shop tool. In its design are combined so many time saving features that most users machine an entire axle in ⅓ to ½ the time required by ordinary methods.

It's a versatile, powerful machine with all the extra ruggedness and brute force for which Niles tools are famous. Which explains why down-time will be almost non-existent—productive time always at a maximum.

If your present axle-machining methods are keeping shop costs unnecessarily high . . . *write* for complete information. Or better yet, call your nearest BLH representative.

BALDWIN BLH LIMA-HAMILTON

Lima-Hamilton Division
BALDWIN-LIMA-HAMILTON CORP.
Hamilton, Ohio

BALDWIN-LIMA-HAMILTON

under 60 lb.; the medium-duty fitting with 1-in. male pipe threads handles loads from 60 to 100 lb.; and the heavy-duty model with 1¼-in. male pipe threads is capable of suspending equipment weighing up to 1,500 lb.

◆

Chest-Mounted Faceshield

Improved vision, elimination of "dead air" space, and relief from binding discomforts are some of the advantages attributed to a protective faceshield announced by Mine Safety Appliances Co., Pittsburgh 8, Pa.

Called the Chest-Mounted Faceshield, this protector is supported by adjustable neck and the chest straps which provide balanced weight distribution. A pliable leather pad rests on the chest without pressure or binding.

The adjustment feature is carried over to the visor itself to provide maximum vision and protection while it can be set at any desired angle, height or distance A metal hinge device enables the worker to make adjustments to individual requirements.

One of the features of the device is the relief from head strain. Allowance is also made for near-maximum ventilation; air gets to the worker's face from all directions to supplant the "closed in" feeling.

The standard model is supplied with a clear Chipruf visor 8 in. long by 0.040 in. thick. Visors are available in various sizes for impact resistance, for chemical splashes, and for hot operations.

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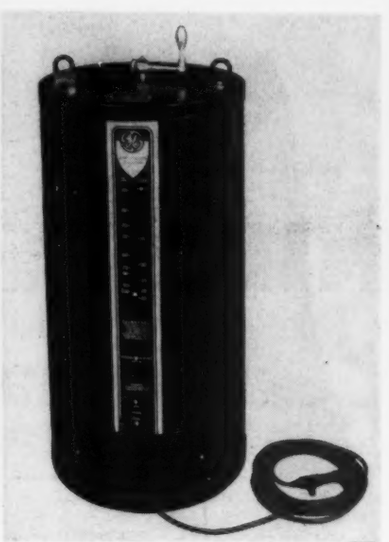


Atomic Hydrogen Welder

A redesign of its atomic-hydrogen transformer welder, incorporating a new hot-start circuit, silicone insulation, and an extra-wide current range, has been announced by the Welding Department of the General Electric Company.

The new design, according to G.E. engineers, not only results in a quicker starting, more durable, more versatile welder than the superseded model, but also permits a 17 per cent reduction in price.

The extra-wide current range of 10 to 100 amp. allows the use of one machine on all applications. The range is divided into two sections, 10 to 35 amp., each extending the entire length of the indicator scale. This allows more precise current settings.

Other advantages of the new welder are noted as a longer coil life because of the silicone insulation, faster starting with the

new hot-start circuit, and a range switch to change from one current range to another without moving the welding cable.

Features of the older model welder which are retained are power factor correction capacitors, portable "start-stop" push-button, automatic gas shutoff, and stepless current control.

The welder operates on 60 cycles, single-phase voltage, with a 75-amp. rating. It is 41½ in. high, 18¾ in. in diameter, and weighs 350 lb.

◆

Metal Forming Machines

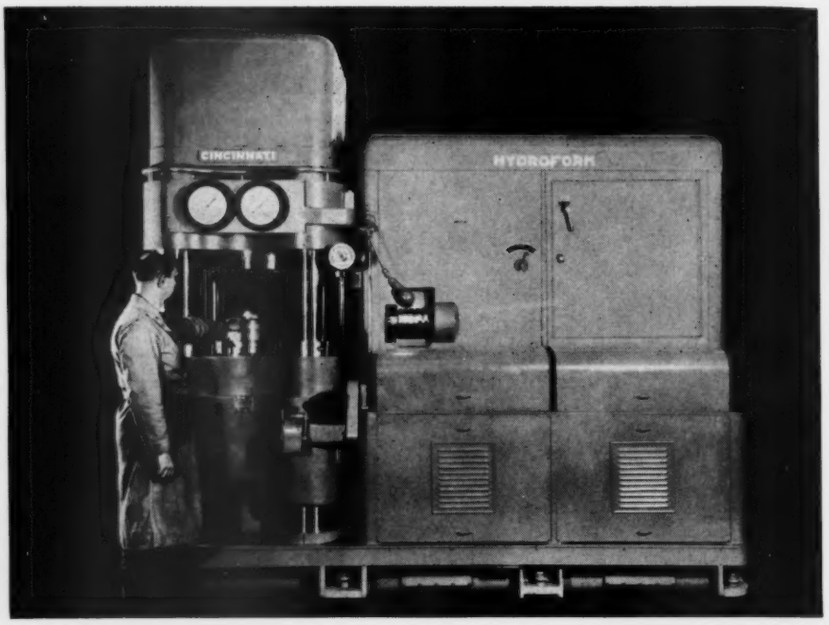
A line of metal forming machines, known as Hydroform, have been introduced by the Cincinnati Milling Machine Co., Cincinnati 9, Ohio. These units are marketed in 12 and 26 in. sizes, and can be made in sizes up to 40 in.

The devices operate on the principle of a solid punch member moving into a flexible, hydraulically pressurized die member; an oil cavity capped with a flexible diaphragm. Sheet metal between these two members is hydraulically formed to the shape of the punch.

In operation, the flexible die member is lowered and locked, initial pressure is released, and then the punch member moves upward into the flexible die member. The blank is pressed tightly against the draw ring to control metal flow. As the punch moves up, pressure is automatically increased on the blank being formed, and the metal is subjected to uniform pressure from all sides. Stripping is accomplished automatically as the punch is retracted. Matching die sets are not necessary.

The machines consist basically of a heavy base in which the bolster plate and punch are mounted, a dome which contains the flexible die member and four strain rods for containing these units. The hydraulic system is equipped with a cooling unit to maintain proper oil temperature. An automatic cycle control unit is arranged with adjustable dogs or master cam plates to control the complete cycle.

Maximum pump pressure developed by the hydraulic system is 8000 psi., although up to 15,000 psi. may be generated in the die member as the punch moves up during the forming process.



To promote safety, the dome is interlocked in its up position while loading and unloading, and in its down position while the work is being formed. The dome control lever can be moved only after a function has been completed. It has a two-position "form speed" control lever to regulate the speed of the forming stroke.

Single-Stage Double-Suction Pump

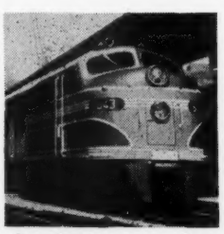
Design improvements in its line of small, single-stage, double-suction pumps have been anounced by the Ingersol-Rand Co., New York 4. These pumps, known as class DMV-DHV, incorporate double mechanical shaft seals with sealed pre-lubricated bearings. Built in 3, 4, 5 and 6 in. sizes, the DMV (for medium heads) and the DHV (for high heads) are designed for general hydraulic services at temperatures up to 200 deg. F. capacities to 2100 gal. per min. and pressures to 150 psi.

Casing design has been made compact and simple. The elimination of stuffing boxes has decreased the shaft length between bearings, making the shaft more rigid. The shaft is not threaded, reduced or slotted at any point over its unsupported length. This construction eliminates any point on the shaft where stress concentration and possible fatigue failure might occur.

Through standardization, three spare parts kits serve all eight pumps in the DMV-DHV line. These kits contain all the parts necessary for a mechanic to restore

(Continued on page 142)

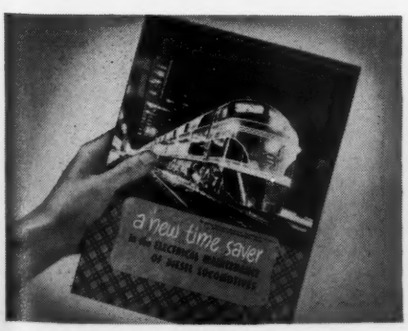
Another chief engineer switches to plastic tape!



The purchasing department of a large mid-Western railroad received this letter from its chief engineer: "Over a period of months we have been making spot tests on 'Scotch' No. 33 Electrical Tape. This tape takes the place of old-style insulating tapes—requires less than half the footage, and goes on twice as fast. Will you, therefore, please see that 'Scotch' No. 33 Electrical Tape is available for all points on the railroad where electrical tape is used."

This engineer found, like hundreds of others, that "Scotch" No. 33 Electrical Tape is ideal for railroad use. It not only goes on faster—it actually *costs less* in the long run. And it lasts and lasts. The plastic backing resists wear from abrasion and is unaffected by water, oil, weathering, acids, alkalies and alcohols.

Try it for neat, compact splices today! Only .007 inch thick with a dielectric strength of 10,000 volts. Order from your supplier.



FREE BOOKLET GIVES THE FACTS on "Scotch" No. 33 and other "Scotch" Electrical Tapes for railroad use. For your copy of booklet E-RR, write: Minnesota Mining & Mfg. Co., Dept. RE-62, St. Paul 6, Minnesota.

OTHER TAPES in the large family of "Scotch" Electrical Tapes speed many other insulating and protecting jobs. Here, a heavy-duty tape protects traction motor leads in up to 90 mph undercar blast. And it lasts for 300,000 miles!

The term "Scotch" and the plaid design are registered trademarks for the more than 200 pressure-sensitive adhesive tapes made in U.S.A. by **Minnesota Mining & Mfg. Co., St. Paul 6, Minn.**,—also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives.

General Export: 270 Park Avenue, New York 17, N. Y. In Canada: London, Ont., Can.

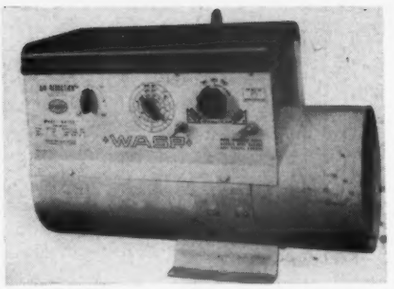
the pump to its original performance.

Cast iron casing, carbon steel shaft and bronze impeller are used to equip the pumps for any non-corrosive service.

◆

D.C. Arc Welders

Model GA "Wasp" direct current arc welders, available in 150- and 200-amp. sizes, have been announced by Air Reduction Sales Company, a division of Air Reduction Company, Inc. Designed to further advance the efficient performance of the Wilson line, the volt-ampere characteristics of



these machines make them especially suited to d.c. straight-polarity Heliwelding with Thor-Tung. Good commutation at all settings, plus the advantages of self-excitation and split-pole, cross-field design are said to provide good operation at all current settings. Continuous overlap from each current range to the next provides an unbroken range of welding current from 30 to 250 on the 200-amp. welder, and 20 to 185 on the 150-amp. machine.

The machines are easily portable when mounted on a two-wheeled carriage and require small floor space because of their compact construction.

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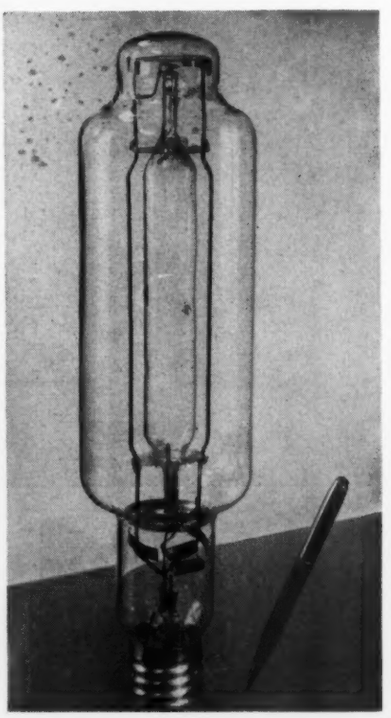

1000-Watt Fluorescent Mercury Lamp

To meet the trend toward larger manufacturing spaces, higher mountings and higher lighting levels both indoors and outdoors, Westinghouse Electric Corporation has made available a 1000-watt, C-H12 fluorescent mercury lamp.

Similar to the 400-watt, J-H1 fluorescent mercury lamp, this new light source provides a golden white light suitable for all types of lighting service except those where close color discrimination is involved. Its ballast is the same as that used for the 1000-watt, A-H12 lamp, and its BT-56 bulb has a specially developed isothermal shape that allows the phosphor coating to function at maximum efficiency.

When activated by invisible ultraviolet light from the quartz arc the phosphor gives off red light. This blends with the blue-green-white light from the mercury arc to give a golden white light with approximately the same color quality as a mixture of equal wattages of mercury and incandescent light. Inside frosting of the bulb provides better diffusion of light and greater uniformity of color.

When used outdoors fixtures should be designed to protect the bulb from a driving rain or moisture-laden insects.